McGraw-Hill Publishing Company, Inc. OCTOBER, 1935 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

This Issue

DESIGN AND PRODUCTION

TRANSPORT

ARMY AND NAVY

PILOTS AND FLYING SERVICES

Published monthly, price 25c a copy. Subscription rates—United States, Mexico and Central and South American countries, $3.00 a year. Canada including duty, $3.50 a year. All other countries $4.00 a year or 24 shillings. Entered as second class matter July 11, 1929, at post office at New York, N. Y., under the act of March 3rd, 1879. Printed in U. S. A. Cable address "McGrawhill New York." Member of A.B.C. Copyright 1935 by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to the above names are reserved by the McGraw-Hill Publishing Company.

AVIATION

Established 1919 — McGraw-Hill Publishing Company, Inc.

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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Contents for October, 1935

Volume 34 Number 10

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McGraw-Hill Publishing Company, Inc., 330 W. 42d St., New York, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Executive Vice President; L. F. Stoll, Vice President; B. C. Putnam, Treasurer; D. C. McGraw, Secretary.

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Jacobs	225	Magneto or Battery	144	125	50	5,490.00
Wright	250	Magneto	148	127	52	7,000.00

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Air Race Audit

Few air meets have ever produced as widely conflicting reactions as the 1935 Cleveland Races. The populace loved it. Technicians yawned. Herewith our own score sheet. For better or for worse the meet brought Cleveland a five year contract renewal.

CREDITS

THE 1935 National Air Races scored the biggest popular success in American airshow history.

The crowds which paid admission to the grandstand—some 200,000 total—were larger than those at any previous meet on record. More automobiles jammed the highways and parking areas. More kibitzers sat on more roof tops to nullify the 4-mile-long canvas fence.

The showmanship was excellent. Events moved with the precision and timing of a musical movie extravaganza. No sooner was one event finished than the signal mortar boomed and the next roared off from the end of the field. Jack Story and his staff kept their day-long chatter through the loudspeakers, spirited, often amusing. If hard-boiled aeronautical visitors grew bored over their groaning buildups of the stunting, Cleveland housewives loved it.

The stands were in good shape, the policing adequate. The handling of traffic was all that could be expected consider-

DEBITS

THE 1935 National Air Races were the biggest disappointment in the history of American airplane competition.

Promotors of the annual shows make much of them as the Indianapolis Speedway of the aeronautical industry, comparing them to the annual automobile races which have sometimes pioneered improvements in automobile engine design.

The inference is that the National Air Races should each year bring out innovations in airplanes and engines; that the races themselves would furnish grueling tests and immediate publicity for the successful.

Yet not a single event of this year's races produced a winning speed even as fast as last year's mark. And the Thompson Race was won in the slowest time since 1930.

Eighteen planes figured in the prize money of the closed course races for men. At least fourteen of them appeared

CREDITS
Continued

ing its huge volume No dust swirled from the field At the far side transport operations went on steadily.

The Marines were there, two dozen strong from Quantico Every day they paraded down over the city and over the field again and again in a half dozen formations Then to top off their act they would dive in one loog snarling line at the midfield target, raining small flash bombs.

The Air Corps sent a squadron of Boeing Pursuits from Selfridge Field and the Three Men on the Flying Trapeze, crack trio from Maxwell Field They showed all they had in previous years, plus some new wrinkles in squirrel cages and formation spinning.

Al Williams' troupe of individual stunters were excellent, as they always have been Outside loops, passing the stands inverted a wing span from the ground, "upside down" landings, were a dime a dozen Gerd Achgelis, Milo Burcham, and Michel DeTroyat went daily through remarkable demonstrations of coordination Al Williams dug deep into his bag of tricks and pulled out an inverted barrel roll. Harold Johnson put his Ford trimotor through loops, rolls and spins The Chevrolet Trio wove their smoke trails across the sky in complex whirls and patterns Captain Richard Grenere, a Canadian, filled in well for the astounding Atcherly whose beautifully crazy boob flying thrilled past Air Race crowds Grenere was rigged out as a country jake, overalls, boots, battered straw hat, false whiskers. His boundings, wing dragging, side ways skidding in a Curtiss Junior really worried many of the flyers

And the parachuting, if you like such things, was beyond doubt big league There were massed jumps, delayed jumps. Clem Sohn turned up for his first national meet appearance His canvas bat wing webbs do let him glide enough to deviate noticeably from a vertical drop. One jumper chased your correspondent under a table when he landed on the canopy next to the press box, but most of the jumps were accurate.

The racing events were beautifully flown Even those which strung out badly after the first lap, produced frequent well executed jockeying for positions

More prize money than has been posted at previous meets prevented the pilots' grumblings that have sometimes marred things in the past, and enough starters competed in each event to keep up spectator interest And no outcome could have been more popular than the unprecedented sweep made by Benny Howard and Harold Neumann of the Bendix, Thompson, and Greve Trophies Together they garnered $18,335 of prize money.

The crowd was glad to see the women back in an event of their own, and cheered Grace Prescott, a San Diego 99er when she came in at the head of the Ruth Chatterton Derby. Miss Chatterton herself flew in with them to floral and florid greetings from the City Fathers.

Finally, the contest for the stock planes with A T C. licenses broke new and interesting ground in American Competitions. The N.A.A. sponsored it Fred Weick of the N.A.C.A. took it in charge. Four manufacturers entered ships in tests that started with careful evaluations of design features and preliminary tests a week before

Beyond doubt the 199,000 people who turned out to see a streamlined Roman holiday, got their money's worth If succeeding shows are as good as this one, their sponsors need not fear deficits.

DEBITS
Continued

in the 1934 races and a good half dozen took part in 1933 Possibly some entrants had souped-up last year's engines, but their speeds didn't show it

Where were the new departures in plane design? In the country which led the world in mounting retracting landing gears on transport ships, only one or two of all the racers that turned up at the most important air races of the year folded the landing gear out of the slip stream Wing clipping obviously reached its limit without flaps a year or two ago, yet flaps were few and far between What advances were apparent in engine design had come from commercial, transport, and military stimulus not from special effort toward racing performance

It is true the Bendix transcontinental racers had wretched weather It is unfortunate that the Hughes racer (which a few weeks later broke the world's land speed record) was damaged in flight tests But the fact remains that Howard's winning time (8 hours and 33 minutes) was slower than Turner's time to Cleveland on his transcontinental record breaking last year And it was well over the 8-19-45 mark set in 1932 Howard did break new ground for Bendix technique by going over the top of the weather crossing at 20,000 ft But Wiley Post in the aging Winnie Mae had gone 100 miles past Cleveland in one of his substratosphere attempts, then turned back with a limping engine to land only eight hours and nine minutes out of Los Angeles

Had Turner not been forced out while leading the field by a half lap some 20 miles from finish, the Thompson Trophy Race would have been disappointing enough, for his average speed was under 240 m.p.h

Howard's Mulligan is a splendid ship Any cabin plane capable of 247.73 m.p.h in a straight away dash deserves all the tribute bestowed on this one But 220 m.p.h. for first in the Thompson Race! The winning time in 1931 was 236 m.p.h. and it has never been below that since. Wright Field could have sent a half dozen service types to top that Caudron's racer with half the horsepower could beat it by 50 m.p.h. And second place went to a racing plane with a Curtiss D-12 in it Even the Seversky amphibian floats and all, which had entered merely for the demonstration effect, made off with prize money for fifth place Had it shown the speed it did two weeks later at Detroit, it might even have won

The races in the limited displacement groups showed even less that was different from last year The women's race was terrible The rules limited them to A T C licensed planes slower than 150 m.p.h. Evidently they all took it seriously for the first five finished under 82 m.p.h

Why can't the race authorities at least permit straight-away speed dashes by the fair sex in ships they can prove themselves qualified to fly? Or set them up to a race with an intermediate displacement limitation? Or stand adamant on last year's decision to bar them completely? The gals added to the show by turning up, but their race added neither interest to the program nor luster to their record

Beyond a doubt the people who turned out to see the last word in airplane and engine progress would have done better to visit the nearest airline base If succeeding race meets fail to produce more new developments than this one, there seems to be little justification for their continuation

Race Snapshots

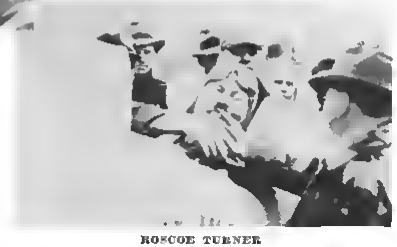
The Candid Cameraman catches some outstanding personalities during the Cleveland air meet

PICTURES BY A. M. PATTERSON

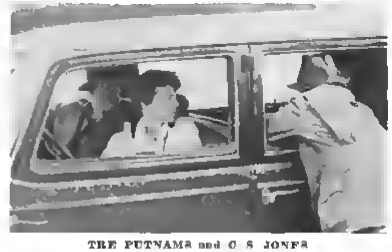
BENNY HOWARD
Mulligan, Mike and Pete won him $17,250

MICHEL DE TROYAT
Flyers liked his outside loops Ladies mentioned Chevalier

GERD ACHGELIS
To rival him, Al Williams lowered a barrel roll



ROSCOE TURNER
Losing the Bendix and Thompson cost him an elaborn



TRE PUTNAMS and C. S. JONES
Laney's students serviced ships. 81 m.p.h. won Amelia's trophy

BILL ENYART
His NAA limers caught disappointing speeds to 231 m.p.h

Official Standing of Contestants

1935 National Air Races, Municipal Airport, Cleveland, Ohio, Aug. 30 to Sept. 2, 1935

Pilot	Entrant	Plane	Engine (Displ.)	Time	Speed	Money
BENDIX TRANSCONTINENTAL SPEED DASH						
Ben O. Howard	Ben O. Howard	Howard Mulligan	P&W Wasp (1344)	8 33 16 5	250 704	$4500.00
Roscoe Turner	Roscoe Turner	Wedell Williams	P&W Hornet (1690)	8.33 39 8	238 522	2500 00
Russell Thaw	Russell Thaw	Northrop Gamma	Wright Cyclone (1823)	10-06 45 00	201 928	1500.00
Roy O. Hunt	Roy O. Hunt	Lockheed Orion	P&W Wasp (1344)	11 41 05 1	124 766	1000 00
Amelia Earhart	United Air Services Ltd.	Lockheed Vega	P&W Wasp (1344)	15 47 06 35	140 570	500 00
RUTH CHATTERTON SPORTSMAN PILOT TROPHY RACE						
Grace E. Prescott	Grace E. Prescott	Travelair	Wright J-5			$450.00
W. S. Woodam	W. S. Woodam	Fleet	Kinner			250 00
Leland Hayward	Leland Hayward	Waco	Wright			150.00
EVENT NO. 2, 200 CUBIC INCH DISPLACEMENT						
Percy V. Chaffee	Percy V. Chaffee	Nicholas Beazley	Pobjoy (173)	4 47 30	125 805	$270.00
Rogue Doo Rae	Eddie Allenbaugh	Allenbaugh	Salmson (125 7)	4 59 16	124 969	150.00
Clarence MacArthur	Owen R. Tilbury	Tilbury	Church (108)	5 10 91	115 789	90 00
EVENT NO. 3, LOUIS W. GREVE TROPHY RACE, 550 CUBIC INCH DISPLACEMENT						
Harold Neumann	Ben O. Howard	Howard Mike	Menasco (489)	14 06 20	212 716	$1125.00
Roger Doo Rae	R. A. Kling	Keith Ryder	Menasco (489)	14 14 65	210 128	625 00
Ari Chester	Ari Chester	Chester	Menasco (365)	15-04 12	199 070	375 00
EVENT NO. 4, WOMEN'S A.T.C. RACE						
Edith Bernaix	Edith Bernaix	Bird	Kinner (372)	10 18 70	81 909	$562 50
Melba Beard	Melba Beard	Bird	Warner (422)	10 51 00	80 964	512 50
Edna Gardner	Edna Gardner	Porterfield	LeBlond (260)	10 38 94	80 455	187.50
EVENT NO. 5, 370 CUBIC INCH DISPLACEMENT						
Ari Chester	Ari Chester	Chester	Menasco (562)	12 40 34	189 584	$945.00
Harold Neumann	Harold Neumann	Fordice & Neumann	Cirrus (510)	12 42 40	192 647	525 00
S. J. Wittman	S. J. Wittman	Wittman	Cirrus (549)	12 49 58	187 164	315 00
EVENT NO. 6, LOUIS W. GREVE TROPHY RACE, 550 CUBIC INCH DISPLACEMENT						
Ben O. Howard	Ben O. Howard	Howard Mike	Menasco (489)	15 25 41	194 930	$2250 00
Lee Miles	Lee Miles	Miles & Atwood	Menasco	15 49 35	189 605	1250 00
S. J. Wittman	S. J. Wittman	Wittman	Hermes Cirrus (539)	15 50 45	189 384	750 00
EVENT NO. 8, 370 CUBIC INCH DISPLACEMENT						
Lee Miles	Lee Miles	Miles & Atwood	Menasco (563)	12 08 11	197 772	$345 00
Ari Chester	Ari Chester	Chester	Menasco (565)	12.09 02	197 525	525 00
S. J. Wittman	S. J. Wittman	Wittman	Cirrus (549)	12 42 41	188 875	315 00
EVENT NO. 9, LOUIS W. GREVE TROPHY RACE, 550 CUBIC INCH DISPLACEMENT						
Harold Neumann	Ben O. Howard	Howard Mike	Menasco (489)	21 42 51	207 292	$2250 00
Marion McKeen	Marion McKeen	Brown	Menasco (544)	21 47 98	206 425	1250 00
Roger Doo Rae	R. A. Kling	Keith Ryder	Menasco (544)	22 24 43	200 829	750 00
EVENT NO. 12, 200 CUBIC INCH DISPLACEMENT						
Percy V. Chaffee	Percy V. Chaffee	Nicholas Beazley	Pobjoy (173)	5 00 85	119 652	$270 00
Roger Doo Rae	Eddie Allenbaugh	Allenbaugh	Salmson (125 7)	5 14 44	114 409	150 00
Clarence MacArthur	Owen R. Tilbury	Tilbury	Church (108)	5 14 75	114 576	90 00
EVENT NO. 11, 370 CUBIC INCH DISPLACEMENT						
Ari Chester	Ari Chester	Chester	Menasco (563)	11 57 97	200 565	$1575 00
Lee Miles	Lee Miles	Miles & Atwood	Menasco (363)	12 25 53	195 671	975.00
S. J. Wittman	S. J. Wittman	Wittman	Hermes Cirrus (549)	12,46 67	187 825	525 00
EVENT NO. 12, THOMPSON TROPHY RACE						
Harold Neumann	Ben O. Howard	Howard Mulligan	P&W Wasp (1344)	40:52.38	220 194	$6750 00
S. J. Wittman	S. J. Wittman	Wittman	Curtiss D-12 (1145)	41 09 23	218 686	3938 00
Roger Doo Rae	R. A. Kling	Keith Ryder	Menasco (544)	42 04.05	213 942	2250 00
Joe Jacobson	Ben Howard	Howard Mike	Menasco (489)	43 02 46	209 105	1500 00
Lee Miles	Seversky Aviation Corp.	Seversky Amphibian	Wright Cyclone (1823)	46 20.54	193 594	375 00
Marion McKeen	Marion McKeen	Brown	Menasco (544)	47 59 28	188 859	525 00

MEN'S A.T.C. RACE

Pilot	Make of Plane	Max. Speed 3-kil. course		Fuel Economy Detroit to Akron			Take-off and climb over 50 ft. barrier		Land over 50-ft. barrier and come to stop		Points for features such as cabin, engine starter, brakes, etc.	Closed-Course Obstacle Race				Total Points
		(m.p.h.)	Pts.	Miles per Gal.	Average Speed (m.p.h.)	Pts.	Dist. (ft.)	Pts.	Dist. (ft.)	Pts.		Dist. to take off over 10-ft. barrier	Av. Spd. (m.p.h.)	Landing dist. over 10-ft. barrier	Pts.	
Geo. L. Hertz	Cessna	152 67	184	13 2	151 80	150	1000	0	650	68	64	900	141 53	550	55	479
Jack Murra	Monocoupe	128 49	116	20.0	116 40	150	803	39	700	54	39	800	111 59	970	24	430
K. M. Gunnop	Taylor Cub	84 27	28	23 9	69 75	115	650	70	456	108	26	500	71 73	670	22	569
Fex Rankin	Ryan	129 75	110	12 0	122 52	92	836	52	912	17	20	930	125 11	950	26	505

Mister Mulligan

1935 turned out to be a Howard year as far as races are concerned. Here's how, as told

By Benjamin O. Howard

MAY I say, right at the beginning, that all my activities are shared with my good friend and associate, Gordon Israel, who, by the way, comes nearer being a genius than anyone I know. Neither of us have had any engineering training. I was forced to stop school shortly after entering high school. Gordon finished high school. This explains perhaps why we have so much fun in figuring things out for ourselves.

We built Pete early in 1930 just for amusement. We learned a lot from Pete and since it paid for itself, we decided it would teach us a great deal to play around with the little fellows. We built racers instead of ordinary airplanes because they were the only ships we could build and pay for out of their earnings. Next came Mike and Ike. We decided to do the job right and to build them in accordance with A.T.C. requirements, which we did. The data and drawings were submitted to the Department and were approved, the engineering inspection order was issued. At the last minute the A.T.C. races were scratched that year so we did not complete the flight tests and the A.T.C.'s were never issued.

But we learned that the little fellows could be built properly and still win races. Mike and Ike paid for themselves.

Then came Mister Mulligan. We had found by studying ships and engines at the races that arithmetic was not always to be trusted in arriving at performance of ships of even slightly different types. We worried along for three years before we decided that we had found the answer. And Mister Mulligan was built to see if we really knew anything. What we wanted was an efficient four-place ship but in order to have a chance at a little financial help from the Bendix Race, we had to lean toward the last possible 10 miles per hour, so we stuck some extra power into it and stepped-up the wing loading.

In the latter respect we went right to the limit. With the overload for this year's Bendix Race (including 300 gal. of gasoline, 30 gal. of oil, and oxygen equipment for two with capacity for seven hours at 22,000 ft.) our gross was 5,355 lb. Our projected wing area (not figuring in the fuselage) is only 197

An apparently ordinary cabin ship with extraordinary performance. Mister Mulligan qualified for the Thompson race at 237 m.p.h., has touched 292 m.p.h. at 11,000 ft. The engine is a supercharged Pratt & Whitney Wasp

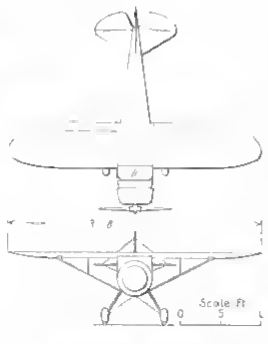
sq ft which netted us a wing loading of 39.1 lb per sq ft. At that, we got off with our load in 1,500 ft of runway, and climbed away from the field at close to 2,000 ft. per minute without exceeding the allowable 550 hp limit.

And we have learned that it is not necessary to build half an airplane to hit high speeds. Mister Mulligan will fly rings around any current commercial ship in America with four people and gasoline for 1,200 miles aboard. Our qualifying time at Cleveland was 247 m.p.h. Turner qualified at 256 m.p.h. but he used considerably more power than we had, and was flying about half the airplane that we were. Neuman averaged just over 220 m.p.h. for the entire Thompson race, using only 485 hp.

Mister Mulligan was built strictly in accordance with A.T.C. requirements except for the installation of the highly supercharged Wasp engine and the mounting of undersized tires. Load factors throughout are actually much higher than required. Its structure is conventional. Fuselage, tail surfaces and landing gear are of welded steel tubing. Sections of the fuselage fore and aft are covered with aluminum sheet, with fabric covering in the center. The wings have spruce spars, built-up wooden ribs and a single internal drag system. The covering is composite, first a layer of ¼-in. Haskelite spruce plywood with a covering of doped fabric. A trailing edge flap of the hinge-type extends from aileron to fuselage on each side. All flying controls are rigged with the push-pull type connection. We have dived the ship to an indicated air speed of 435 m.p.h. at 12,000 ft with hands and feet off the controls without any indication of flutter.

Landing gear and tail wheel shock absorbers are rubber disks under compression. The main wheels have a deflection of 8 in., the tail wheel 5 in. Goodrich six-ply, 750x10 tires are fitted.

Power plant is a Pratt & Whitney supercharged Wasp with 13.85:1 blower and 6.05:1 compression ratio. It is rated at 550 hp at 11,000 ft. A Lycoming-Smith controllable pitch propeller was fitted. Pitch adjustment ranged from 18 deg. to 32 deg.



The ship actually has all the features of a normal four-place cabin type including large baggage compartment, controlled ventilation, dual radio sets with duplicate power supply, a full set of dual controls, all necessary blind flying instruments, and oxygen equipment for two.

The general specifications of Mister Mulligan include span 31 ft. 8 in.; length overall 25 ft. 1 in., wing area 137 sq ft (neglecting area over fuselage), 150.7 sq ft (including 60 per cent of wing area over fuselage); weight empty 2,600 lb., useful load 1,610 lb.; gross weight (normal) 4,210 lb., wing loading (137 sq ft. basis) 30.7 lb. per sq ft.; power loading 7.65 lb. per hp.

The performance based on the normal gross weight is as follows: Maximum speed (sea level with full available 830 hp.) 287 m.p.h., maximum speed (sea level at rated 550 hp.) 251 m.p.h., maximum speed (at 11,000 ft., 550 hp.) 292 m.p.h., cruising (sea level, 75 per cent rated power) 231 m.p.h.; cruising (11,000 ft., 75 per cent rated power), 262 m.p.m., cruising (17,000 ft., 75 per cent rated power) 292 m.p.h.; climb (sea level at rated hp. at 150 m.p.h.) 2,800 ft. per minute; climb (sea level at full available 830 hp., 150 m.p.h.) 4,450 ft. per min.; landing speed (full load, flap down) 64 m.p.h.

Based on lessons learned from Mister Mulligan we are now working on a design for commercial production. It is too early to discuss its details but we have in mind a ship for four capable of cruising 800 miles at 7,000 ft. at close to 200 m.p.h. on just under 300 hp.

On the basis of a projected wing area of 137 sq ft, Howard took Mulligan off Burbank's Air Terminal for the Bendix race with a wing loading of 38.1 lb. per sq ft.

A study of the design factors that affect the skill required to land a conventional airplane. Coming at a time when interest is centered on airplanes for private owner use, Professor Koppen's analysis of what makes one plane easier to land than another points a way toward the solution of one of the designers' most critical problems—control during landings.

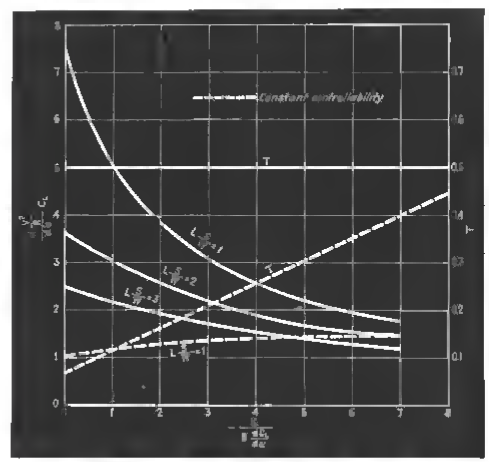
Control Sensitivity

By Otto C. Koppen
Associate Professor of Aeronautics
Massachusetts Institute of Technology

ONE of the technical factors that limits the use of the airplane as an everyday vehicle is the skill required to make an ordinary landing. If the technique required were simplified, training and practice expanse, not to mention sales-resistance in general, would be materially reduced.

Practically all of a student's preliminary training time is used in learning to land, and the trend of airplane design has been to make matters steadily worse for him. In the early days it was not considered unusual for a student to take a few hops with his instructor in the morning and to fly solo in the afternoon. Although the general level of flying skill was much lower, students unquestionably flew the frail machines of the day without much trouble in remarkably short time. Subsequent improvement in performance has been made without any regard to the skill required to fly the airplane, and beyond all doubt the pre-war student could not have made such rapid progress on modern machines.

The type of airplane used for training still has a considerable effect upon the time required to solo. The average student takes about six to ten hours to solo the conventional machine now widely used for training purposes, but when light airplanes (with wing loadings between 4 and 6 lb. per sq ft.) are used, dual time has been known to drop to about two hours.



It is generally assumed that the difference of training time is due directly to the reduction of landing speed. That a decrease of landing speed of 10 m.p.h. should reduce training time by as much as two-thirds is remarkable. It is more reasonable to expect that the ease with which a novice learns to land a light airplane depends upon factors that are only indirectly related to the landing speed.

An analysis of the controlled motion of the airplane while landing shows that the motion depends upon the relation between the control moment and the damping. The total damping is the sum of two components, the damping of pitching motion and the damping of motion normal to the flight path. For geometrically similar airplanes, the first motion is proportional to the size of the airplane, and the second is inversely proportional to the wing loading. Since there is a strong tendency among designers to make airplanes geometrically similar longitudinal control response becomes more tricky as the wing loading is increased.

To assure a private market, it is necessary to produce a small high speed airplane having the control characteristics of a light airplane. To produce the desired results, therefore, the airplane cannot be geometrically similar to the average machine now in use.

In landing the pilot attempts to level off at a short distance above the ground and to hold that altitude until the airplane settles. Both in leveling off and in holding a constant altitude a small and accurate motion of the control is required. Since flying an airplane is a constant process of error and correction, the difference between a trained pilot and a novice is that the former makes smaller approximations of the correct control movement and allows a shorter interval of time to elapse before correcting an error of movement.

The final test of flying ability does not depend upon the movement of the controls but upon the actual flight path of the airplane. The deviation from the desired flight path for a given control error is proportional to the product of the acceleration normal to the flight path and the square of the time to bring the control back. Any airplane that is

manufactured for the private pilot should be designed to have a normal acceleration per degree of control movement at least no greater than that on the light airplane. For brevity, the normal acceleration per degree of control movement will be called the control "sensitivity."

The control sensitivity may be estimated in the following way. The movement coefficient of the airplane in a curved flight path is

$$\frac{M_A}{\frac{1}{2}\rho V^2 S c} = C_{m_o}\frac{c}{L} + C_L\frac{c}{L}\left(\frac{d}{c} - h\right) - \frac{dC_L'}{d\alpha}\frac{S'}{S}\,a - \frac{dC_L'}{d\alpha}\frac{S}{S}\,\frac{LQ}{V} \quad (1)$$

where

$$\alpha_t = \alpha - \epsilon + a_t + Tb$$

and

C_{m_o} = the wing moment coefficient at zero lift
C_L = the wing lift coefficient
$\frac{dC_L'}{d\alpha}$ = the effective slope of the tail lift coefficient curve
c = the wing chord
L = the distance from the center of gravity to the tail post
h = the percent of chord aft of the leading edge about which the wing moment coefficient is constant
a = the distance from the leading edge to the center of gravity
S' = the area of the horizontal tail
S = the wing area
α = the angle of attack of the wing
α_t = the angle of attack of the tail
a_t = the angle of setting of the tail
ϵ = angle of downwash
b = the elevator angle (positive when the trailing edge is down)
T = the ratio $\frac{d\alpha}{db}$
Q = the angular velocity of pitch about the center of gravity in radians per second
V = the forward speed of the airplane in feet per second

The equation of equilibrium of forces normal to the flight path is

$$C_L\tfrac{1}{2}\rho S V^2 = W\cos\theta + \frac{W}{g}\frac{V^2}{R} \quad (2)$$

where θ = the path angle
R = the radius of curvature of the flight path
g = the acceleration due to gravity

The angle of the flight path is usually small so that $\cos\theta = 1$ may be assumed. Then since

$$\frac{1}{R} = \frac{Q}{V} = g C_L \rho \frac{S}{W}\frac{1}{V^2} \quad (3)$$

Experimental records of pull-ups show that the velocity along the flight path remains constant for an appreciable period after the controls are moved. Therefore the velocity may be assumed constant for purposes of this analysis.

The lift coefficient of equilibrium for a given control movement will then be obtained by substituting the value of $\frac{Q}{V}$ of equation (3) in equation (1).

Writing $A = \left(\frac{a}{c} - h\right)$ and $B = \frac{dC_L'}{d\alpha}\frac{S'}{S}$

$$C_{m_A} = C_{m_o}\frac{c}{L} + iC_L\frac{c}{L} - B(\alpha - \epsilon + a_t + Tb) - 57.3\,iB\left(gC_L\rho\frac{S}{W}\frac{b}{V^2}\right) \quad (4)$$

The angles α and ϵ are functions of C_L:

$$\alpha = C_L\frac{d\alpha}{dC_L} \qquad \epsilon = \frac{pC_L}{R}$$

where p is a constant and R is the wing aspect ratio. Substituting and differentiating C_L with respect to b,

$$\frac{dC_L}{db} = \frac{T}{\frac{c}{L}\frac{A}{B} - \frac{d\alpha}{dC_L} + \frac{p}{R} - 2.19\frac{LS}{W}} \quad \text{At sea level} \quad (5)$$

The denominator of this expression may be simplified by differentiating (1) to find the slope of the pitching moment curve when Q is constant.

$$\frac{dC_{m_A}}{d\alpha} = K = \frac{dC_L}{d\alpha}\frac{c}{L}\,i - B\left(1 - \frac{d\epsilon}{d\alpha}\right) \quad (6)$$

Then

$$\frac{c}{L}\frac{A}{B} = \frac{d\alpha}{dC_L} - \frac{p}{R} + \frac{K}{B}\frac{d\alpha}{dC_L} \quad (7)$$

Substituting (7) in (5)

$$\frac{dC_L}{db} = \frac{T}{\frac{K}{B}\frac{d\alpha}{dC_L} - 2.19\frac{LS}{W}} \quad (8)$$

The variation of normal acceleration with elevator angle is

$$\frac{d\frac{V^2}{R}}{db} = \frac{d\frac{V^2}{R}}{dC_L}\frac{dC_L}{db} \quad (9)$$

From (2)

$$\frac{V^2}{R} = \frac{S}{dC_L}\,g\rho\frac{V^2}{W} \quad (10)$$

If the airplane is in equilibrium before the control is moved

$$W = C_L\tfrac{1}{2}\rho S V^2 \quad (11)$$

Substituting (11) in (10) the variation in normal acceleration with lift coefficient for a unit change of lift coefficient from the equilibrium value will be

$$\frac{d\frac{V^2}{R}}{dC_L} = \frac{g}{C_L} \quad (12)$$

Substituting (8) and (12) in (9) the final value of the normal acceleration with control surface angle will be

$$\frac{dn}{db} = \frac{T}{\frac{K}{B}\frac{d\alpha}{dC_L} - 2.19\frac{LS}{W}}\left(\frac{g}{C_L}\right) \quad (13)$$

The value of T depends upon the ratio of elevator area to total tail area. If T is constant, and the designer's tendency is to keep it so, $\frac{K}{B}\frac{d\alpha}{dC_L}$ must be increased numerically, since it is normally negative, if the sensitivity is to remain constant as $\frac{LS}{W}$ is decreased. However, if controllability is measured by the maximum angle of attack at which the airplane may be held with full up elevator with a given stabilizer setting, a change of the ratio $\frac{K}{B}$ will also affect the controllability.

Fig. 1 shows $\frac{dn}{db} = \frac{g}{C_L}C_L$ plotted against $-\frac{K}{B}\frac{d\alpha}{dC_L}$ with constant T for three values of $\frac{LS}{W}$ and for one value of $\frac{LS}{W}$ with T varied to give constant controllability. If the ratio of elevator area to total horizontal tail area is varied to maintain constant controllability as the center of gravity location and tail area are changed, the curve for the small highly loaded airplane remains below that of the light plane over the useful range of dimensions.

An examination of the effect of the factors involved shows that the sensitivity of an airplane may be reduced:

(a) By reducing the ratio of elevator area to total tail area.

(b) By reducing the static stability by shifting the center of gravity aft.

(c) By increasing the horizontal tail area and aspect ratio while keeping the static stability constant.

(d) By increasing the maximum lift coefficient.

The recommendations (b), (c) and (d) assume constant controllability while (a) would require an adjustment of the stabilizer to attain maximum lift. Recommendation (b) appears to be contradictory to equation (13). However for constant controllability the numerator decreases more rapidly than the denominator, since K affects only the first term of the latter.

Pursuit Ideal

An Italian View

By Comdr. Silvio Scaroni

Heterodox to the point of heresy are the ideas here set forth by Commander Scaroni, much decorated pursuit ace of 1918, subsequently Air Attaché to Washington and to London, special aerial aide to Il Duce, and commander of a pursuit group. Most surprising, perhaps, from a student of military flying from a country that holds the present world's speed record, is his assignment of speed to the rearmost rank of significance among desirable pursuit qualities.

WEAPONS should be developed on the solid basis of the experience of those who have used them in war. No one else can be in a position to appreciate their qualities from the combat point of view, or have the practical capacity for checking up their defects. Where aircraft are concerned, practical results must be obtained chiefly by compromise between the aspirations of those who use them and those who have the responsibility of constructing them. If in this conflict something has to be sacrificed, it should preferably be the ideas of the designers and constructors (no matter how logical they may be) rather than those of the pilots.

So far, the outcome of this bloodless battle is very much in favor of the technicians; which accounts largely for the fact that a fighting pilot today is faced with several problems of a tactical nature which have been inadvertently given to him by the constructors and designers because of their imperfect knowledge of the exigencies of combat.

It is unreasonable to expect that the actual necessities of aerial combat could be evaluated exactly by men who have never experienced them. In larger planes the non-piloting engineer has at least an opportunity to gain the viewpoint of a rear-cockpit observer. Single-seaters render even this impossible.

My opinion is that the single-seat pursuit is absolutely indispensable in an air force. No matter what some expert may say about its being almost obsolete on account of its limited range, its inability to attack well-armed bombing planes in close formation, and so on, it is still indispensable. As far as I know, no air force plans to give up its construction. In some future time, perhaps, the single seater will go out of business; but while waiting for the remarkable bomber which may ultimately render it obsolete, let us see what are the aspirations of a fighter in this field.

I count the efficiency of a single-seater fighting plane as based principally on the following qualities, given in what I believe the order of their relative importance in combat:

(a) Powerful armament, very conveniently and simply operated by the pilot in the air.
(b) Good rate of climb.
(c) The closest possible approach to 100 per cent vision.
(d) Good maneuverability.
(e) High speed.

More shots per minute

Gun failure is one of the greatest dangers of combat. The best you can hope for with a jammed gun, if you cannot put it immediately in working order, is to run away, if your enemy will be kind enough to let you do so, and leave him master of the battlefield. Even to run away is not always easy, especially if the engagement has taken place somewhere deep in unfriendly territory. In such cases about the only chance is to climb as high as your plane

will go; then try to get home as quickly as possible.

There is no possibility of exaggerating the importance of your armament. If you are much faster than your enemy you may certainly be able to overtake him but perhaps just in time to be shot down, if his plane happens to be better armed than yours. I think, therefore that, once due consideration has been given to a reasonable degree of structural safety and reasonable speed and maneuverability, everything should be sacrificed to armament. To stake everything on a single gun, no matter how good it may be, has never been safe enough. In my opinion, mounting three machine-guns makes a good compromise among (a) the demand for volume of fire adequate for defense and offense (b) the difficulties of installation, and (c) the weight of the guns and ammunition.

Gun position

Armament must be so placed as to be easily handled by the pilot in case of jamming. It becomes practicable to install machine guns in the wings only when they have become so reliable as to give a reasonable assurance of not even the slightest difficulty in functioning. No matter how minor the trouble may be, with arms so placed the pilot is absolutely helpless. He might find himself at the mercy of the first comer by a trouble which he could eliminate in two seconds, were the guns within reach of his hands.

In very few seconds the fighting pilot must aim, shoot, execute the maneuvers necessary to get out of range of the enemy plane, and try to put himself again in a good firing position if the first attack has met with failure, and it is well known that the more distant we place the line of fire from the line of sight, the greater will be the error of parallax.

The aim in war is to destroy the target, and to do so from a pursuit aircraft there is nothing at your disposal but the gun. Speed and maneuverability are absolutely necessary, but nevertheless they are auxiliary elements. We certainly must do everything possible to strike quickly, but first of all we must obtain adequate volume, efficiency, and certainty of fire.

I believe it is much better to have a good volume of fire from a reliable machine-gun with a good and accessible installation on a plane of average speed, than to fly a very fast ship that has an imperfect installation of the armament. A plane which is much faster than another one will not be able to attack it, if the second has a better climbing speed, and a slower plane, which happens to be a few thousand feet above a faster one, can very often overtake it by virtue of the extra speed it can accumulate in a dive. Cases of that kind were not infrequent during the late war.

I do not believe it possible to use flexible machine-guns. To install them would be to go back to pre-war times, when the only machine-gun was placed on top of the upper wing. Aiming was a difficult affair, and inaccurate at best. It would be more difficult, if not impossible, today, when the speed of the fighting plane has doubled.

[The possibility of supplementing existing pursuit armament with a fixed gun firing back under the tail to repel rear attack or a flexible one which the pilot can aim upwards or both, is a hardy perennial suggestion coming most often from British sources. Commander Searoth shares with most other pilots of experience a pronounced lack of enthusiasm for any combination of the duties of flying straight ahead and simultaneously peering through a periscopic sight to follow a moving target somewhere overhead—Ed.]

Climbing to victory

As many writers have already observed, and as all pilots who have war experience know, it would be impossible to exaggerate the importance of a superior height in an aerial combat. From a superior altitude one has a better view of the battlefield. With that advantage one finds combat easier and safer, since one does not run the danger of falling involuntarily into a spin, as sometimes happens when firing from below. Also, in coming in from below, the time one can keep the enemy plane under attack is shorter. The extra speed one may accumulate in a dive can be exploited at the proper moment to get to a suitable distance and position for firing. Superior height means to the pilot an almost complete liberty of maneuver, which in its turn means the possibility of choosing the suitable moment for a decisive attack, and it has a tremendous moral effect upon the enemy who feels himself all the time dominated from that advantageous position which is prohibited to him. Who of the pilots that had war experience with fighting planes does not remember the feeling of depression, when in spite of the most skillful maneuvering you found yourself never able to get to the same height of your enemy, who seemed to enjoy playing with you as a cat does with a mouse? Sometimes you would chase an observation plane for the whole length of the battle-line, and although flying a faster ship you could not engage it because of inability to get to its height and at the same time to develop enough horizontal speed to make up the initial distance which separated you from your target.

Expert opinion

I agree perfectly with Maj. Oliver Stewart (British authority on air warfare, British correspondent of AVIATION, and author of an article on recent tactical trends which will appear in an early issue) when he says "Height ... constitutes an overwhelming advantage", and again "Every 100 ft. less between a friendly patrol and an enemy patrol above, reduces the advantage of the enemy."

And a French writer, De Chavagne, says: "In 1917, when the German pilot, at 15,000 ft. would execute a very sharp climbing turn, the Spads could not do the same. Therefore the French pilot was forced not only to give up the idea of attack, but to break off the engagement very rapidly, since he could not shoot with a fixed gun against a machine all the time higher than himself."

And again: "When a French pilot happened to be faced with an Albatross two-seater he could attack it only if it was flying over French territory. Otherwise he would have run a useless danger, since the fatal moment would soon arrive in which the Albatross, by virtue of superior altitude, would gain the advantage."

The French ace Deullin wrote: "One must get the advantage of the altitude", and Rene Fonck: "... to fall from above has always seemed to me the best tactics." Major Rickenbacker in his book tells some good stories which further illustrate this point. From England comes McCudden: "... the Huns did most of the shooting, for they were above and had the initial advantage on their side. ..." Von Richthofen, the German ace of aces, contributes: "One must keep himself above the enemy." All nations swell the chorus. These are the opinions of men who have the experience of hundreds of air combats; who have acquired experience in the only manner in which it can be acquired. I think it is possible to draw the theory as true as it was in 1918. "Higher in order to attack with advantage, higher in order to better defend oneself."

Being myself of this opinion it is quite natural that the plane which I would like to fly should have a light wing loading and a still lower power loading, making it possible to obtain at the same time a very good rate of climb, a short turning radius and an easy control in steep banks at great heights. [The very specific recommendation for light wing loading, running counter as it does to all the design tendencies of the last dozen years, must be particularly emphasized. Though the author modestly denies his own qualifications as an engineer, no engineer can dissent from his conclusion that if high rate of climb and ceiling and short turning radius are paramount objectives a low wing loading is called for—Ed.]

Importance of vision

Vision has always been of paramount importance. It will be all the more so in the future, for three reasons which are clear to everybody who has flying experience:

(a) Ever-increasing speed, which reduces the time available to avoid obstacles and judge distances;

(b) The trend toward flying in close formations;

(c) Ever-increasing number of planes which will certainly be involved in future aerial combat.

The disposition of the various individuals in the section and of the various sections in a formation have often to be governed by the peculiar vision characteristics of the planes used. And the great importance of this element in a fighting plane is shown also by the fact that most methods of attack recommended in modern literature (attack from above and in front, attack from underneath a wing-tip, and attack from above a wing-tip) are based on the fact that the wing in the conventional position (on a biplane or for attack from below, on a low-wing monoplane) does not allow the pilot to perceive the enemy planes from those directions.

In order to obtain a good and easy maneuverability and to give more structural rigidity to fast planes, the natural tendency is to make the machine more compact. This compactness means bringing the surfaces and the various elements of the plane as close as possible to the center of gravity. But unfortunately the pilot, too, must necessarily be placed near that spot, and little by little he finds himself submerged. This does not in the least favor his wish for a good field of view in all directions.

With the hope of increasing the speed of a plane by a very few miles an hour, one of the means at the disposal of the constructors has been to diminish the cross section of the fuselage, and if the poor pilot did not have in his defense the irreducible dimensions of the motor our good friends the constructors would already have locked him up in something which too closely resembles a strait-jacket.

On the other hand, every day the necessity arises of increasing the number of instruments and other accessories of navigation, communication, and the like. It cannot be said that all this equipment draped around him simplifies the problem of facilitating the pilot's necessary movements, especially when he is dressed to resist the low temperatures of the higher altitudes.

Pushers for pursuit

But no matter what noble aspirations one may formulate in this question of vision in order to fly it is still necessary to have a fuselage, a wing, controls and an engine. To eliminate any of these organs at the present stage of technical and scientific development does not seem to be an easy task, even for the smartest designer. So the pilot must convince himself that to eliminate the "blind zones" is practically impossible. That being so, we have to content ourselves with the half-solution of seeking to put them where they will do the least harm.

A pilot in a pursuit plane is so placed that he cannot turn on his seat, and therefore cannot watch a plane coming from the rear. Rear-vision mirrors are but palliatives, and not many pilots entertain illusions about them. Why not, therefore, concentrate blind zones in the place where the pilot's position makes improvement already hopeless, and then eliminate all other zones from which a menace could come without being no-

PURSUIT PRACTICE

U. S. A.—The Boeing P-26

Great Britain—The Gloster Gauntlet

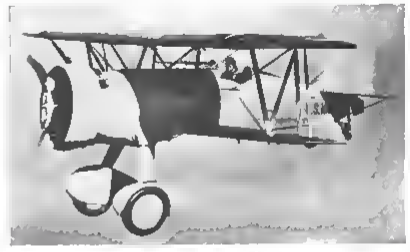
France—The Dewoitine D 371

Italy—The Vulle

Poland—The PZL-X1

A COMPROMISE MUST BE STRUCK BETWEEN TWO TYPES.

The Macchi M-41 bis.



The Curtis Hawk

ticed? The pursuit pilot today is absolutely unprotected against surprise from the rear, if from time to time he does not execute maneuvers. At best, contortions in the cockpit can clear for him only a fraction more of the sky behind him. In no other way except by maneuvering can he get rid of the blind zone, which follows him like a shadow.

I believe it much better for a pursuit pilot to have one single blind zone, no matter how large, but one only, than to have several, even if individually smaller. From any one of several zones a fatal menace may come at any moment without being noticed until it is already too late to take defensive action. It seems, therefore, that to the physical limitation of the pilot there might just as well be added the wing and motor, thereby eliminating all blind zones forward and obtaining a perfect field of vision in that direction. When the pilot knows where his only weak point is, he may concentrate his attention there.

The pursuit flying-boats current in Italian aviation for many years, a type of which the Macchi M 41 bis is a good example, were almost ideal from this point of view. One could hardly ask for anything better than a reproduction of their vision characteristics, minus the performance handicaps to which they are of course subject.

Problems of maneuverability

The two important problems which enter in the maneuverability of an airplane are those of longitudinal and lateral movements. From the fighter's point of view, the latter, involving rotation about the longitudinal axis should receive the greatest attention from the constructors, for it certainly is the most important.

The lateral maneuverability of a single-seater landplane is usually far better than that of a pursuit flying boat. A plane of the type of the M 41 bis having its 800 lb. or so of engine placed at about 3 ft. from the center of gravity, and an equal weight of hull and fuel and so on placed at an equal distance on the other side, all of which must rotate about the longitudinal axis when the machine rolls, cannot be expected to have a lateral maneuverability equal to a landplane with all the masses grouped along the longitudinal axis. It is therefore necessary that, in the ideal plane of which I am speaking, the engine should be placed in the rear of the pilot to retain good vision and perfect gun installations, but, at the same time, it should be as near as possible to the longitudinal axis through the center of gravity to maintain the good maneuvering qualities inherent in the landplane of the conventional type.

Major Stewart says "... maneuver is the sole defense of the single-seater." I shall not take it literally; if I did I would not quite agree with him, for I have always counted on my gun, too, for my defense, and used maneuver as the sole defense only when my armament was out of order. But that good maneuverability in a single-seater plane is of paramount importance nobody can deny.

The price of speed

Many of my readers must have been surprised to see me putting top speed in the last place in the enumeration of pursuit qualities. Any opinion is the result of practical experience coupled with studies on the question involved. And as no two people ever have the same practical experience, and further more never evaluate the same experience in the same way, it is no wonder that we should have different ideas on the same subject.

Although I am far from minimizing the importance of speed in military planes in general, I cannot believe it the most important characteristic of a fighter. If we could obtain high horizontal speed and still maintain more or less unchanged the other essential military characteristics, of coarse everyone would favor it. But unfortunately that is not the case with modern fighting planes. The first negative result of high speed as a primary objective is a sharp decrease in power of maneuver. Even today, when one puts a fighter into a moderately steep dive, the controls rapidly become stiff enough to make the plane about as maneuverable as a stone thrown in the air.

Although high speed allows the individual pilot a better chance for surprise, and gives him the chance of entering into or getting out of a fight whenever he wishes it, I am still not convinced that it is the most important quality, as many pilots seem to believe. Assuming Power A suddenly attacked by Power B whose airplanes are slower than those of A. The air force of Power A will never be able to prevent an attack from the air force of B (no matter how fast A's pursuit planes are), as B will always have the advantage of surprise and A will never be able to concentrate a sufficiently strong force of planes to oppose the attacker in every possible area of conflict. If the air force of B should for any reason desire to bring on a general battle with its opponent, it is only necessary to make a daylight attack in full strength on some of the most important of A's centers.

The designer's mistake

As the foremost characteristic of aviation is mobility, popular opinion has gradually come around to the conclusion that speed by itself solves almost all military problems. Armament then begins to be considered as a troublesome affair uselessly cumbersome to be tolerated just because a military plane, to be so called, has to be armed, in one way or another. Of course, it is partially because of the armament that the designer cannot lay out a smaller fuselage, and it is still the armament's unpardonable fault if the exterior line of the fuselage shows some deformity. In looking over some modern planes, it is obvious that the designer gave less thought to constructing a good wing to carry a very good machine-gun installation than he did to applying armament of whatever available type in some sort of fashion to a very fast wing.

I cannot agree with those who seem to believe that a military plane is almost solely an aerodynamic problem; and am afraid I shall never approve this theory unless someone will give me a guarantee that the air force to which I belong will always have a *large* superiority of speed over any air force which might be our potential enemy. I find it easier to convince myself that we shall be able to develop an armament just as good as that of the potential enemy, than that we shall obtain, by whatever sacrifices of armament quality, the superiority of speed necessary to give an equal sense of security.

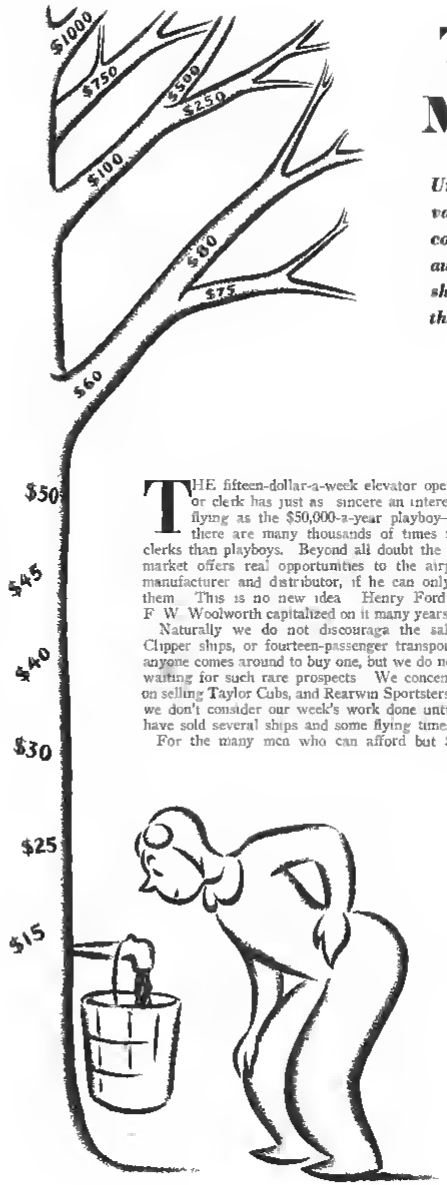
High speed ought to be made consistent with good armament installation, good vision, a good maneuverability, comfortable location for the pilot, good installations of equipment. Everyone would then be enthusiastic about it, but unfortunately up to now high speed has been the fiercest enemy of all those qualities.

The ideal type

What I should like to have would be a plane which would represent a harmonic fusion of two types, the Macchi M 41 bis (boat) and the Curtiss Hawk or Hawker Fury. I would like to conserve the splendid vision of the single-seater boat type, to maintain the pusher arrangement in order to eliminate gun synchronization entirely, to keep as close as possible to the conventional construction of the land plane (in so far as the position of the engine on the longitudinal axis is concerned) in order to retain its superior characteristic of maneuver.

These proposals will undoubtedly meet with strong objections from designers and constructors, principally on the ground that the high speed of a modern fighter and the necessity of its being highly maneuverable require a high factor of safety, which seems difficult to obtain in the type of construction that I suggest.

But here I discover myself going into the purely technical field. There I defer to the designers and constructors, asking only that they suggest other solutions if they see them, equally compatible with the obligations and aspirations of the pursuit pilot.



Tapping the Mass Market

Until the aviation industry learns the value of the poor man's dollar it will continue to be in the doldrums. The author has found a road to black ink by showing others how to own and operate their airplanes on a minimum of capital.

By Alfred B. Bennett
President, Bennett Air Service

THE fifteen-dollar-a-week elevator operator or clerk has just as sincere an interest in flying as the $50,000-a-year playboy—and there are many thousands of times more clerks than playboys. Beyond all doubt the mass market offers real opportunities to the airplane manufacturer and distributor, if he can only see them. This is no new idea. Henry Ford and F. W. Woolworth capitalized on it many years ago.

Naturally we do not discourage the sale of Clipper ships, or fourteen-passenger transports if anyone comes around to buy one, but we do not sit waiting for such rare prospects. We concentrate on selling Taylor Cubs, and Rearwin Sportsters and we don't consider our week's work done until we have sold several ships and some flying time.

For the many men who can afford but $2.50 per week we have a "pay as you go" plan with twenty minute flying lessons. For the man who can afford to pay in advance for time, we have a more economical and more rapid system of training. For the man who buys a ship we furnish free instruction, and a plan that enables him to own his ship and to start himself in business without a capital outlay.


Alfred B. Bennett

There has been a persistent belief that every airplane sold destroyed a prospect. This may be so for $80,000 club planes, but we are certain that it does not apply to $1,500 ships. We find quite the opposite to be true. Every airplane sold creates a new demand. Paradoxically, we encourage competition for we find that it pays. We actually spend a large part of our time setting others up in busines with the planes we sell them. Which brings us to the bulwark of our sales policy—the "Bennett Plan."

Airplanes that buy themselves

Our plan is essentially a system of making an airplane buy itself. It enables anyone to own an airplane by substituting effort for capital, making use of the financing provided by the Aviation Funding Corporation (one-third down, balance in twelve monthly installments, charges, including insurance, about 20 per cent) or by Dr. Howard Trott, of Hemlock, N. Y. This is the way it is done.

If, by exercising your oratorical ability among those in your locality who want to fly, you can get twenty reliable people to advance $25 each for flying time you have raised the down payment of $490 on a Taylor Cub. The money can be held in

escrow pending delivery of the ship. After delivery you need net but $4.90 each per student per month to cover the installments. If fewer students are signed up, their individual contribution naturally must be greater. This method is preferable to cooperative ownership because it eliminates questions of title and the resulting squabbles. The foregoing are the essential factors. There are many variations and many different methods of application.

If you are already an airport operator you can afford to offer dual time at $7.50 per hour ($2.50 per twenty-minute lesson) and $6 solo. Offer a discount of 30 per cent for 50 hours to those who will pay $60 in advance and the balance as they fly at $5 per hour for dual and $3 per hour solo. To those who do not want the full 50 hours sell them a solo course for $50 agreeing to deduct this amount from a new ship if they buy through you. From this and other sources of revenue ($1 rides and $2.50 lessons), it is usually possible to raise the first month's installment of $87.50 in the first week of operation.

If you are a transport pilot without a field, arrange with your local airport operator to use his field and hangar paying him a commission of 5 to 10 per cent of your gross receipts. If you do not have a transport license you will probably have to hire a pilot to instruct by the hour until you are in a position to do the job yourself.

If you have a club say with a membership of 30, an assessment of $20 each and a monthly contribution of $3 each will clear expenses. This provides a brand new airplane and, after it has started operating it can be made to furnish sufficient revenue to eliminate dues or assessments for flying purposes.

We do not sell a man an airplane and then forget him. We furnish a series of services to assist the enterprising operator in getting started. We help him to design business cards, posters, and windshield stickers showing rates, location of airport and otherwise advertising his service. We furnish cuts and assist in preparation of copy for local newspaper publicity. We set up a simple but effective accounting system. Where practicable we send an expert to assist in the process of getting started.

Our plan also has something to offer the established operator who is unfamiliar with the appearance of black figures on his financial statement. It usually sells itself for it points the way toward acquiring new equipment more easily than used machines.

We do more than preach our plan to others. We practice it. Thus we keep ourselves supplied with students—the raw materials from which new operators are made. To newcomers in aviation we offer a transport course at $880 and a limited commercial course at $240 complete including ground study supervision and airport and flying school management.

For those who just want to learn to fly solo, the wherewithal consists of a week's vacation $38 and a round trip ticket to Hightstown $50 goes for the course to solo. We have found farmhouses that offer good food and board for $8 per week. The average student can take an hour a day and solo in a week. If he decides to buy a plane he receives full credit of $50 on the purchase price. But one doesn't have to solo in a week. A single twenty-minute lesson weekly is sufficient for those who wish to pay as they go. Our experience has completely exploded the theory that one must take time every day to learn to fly.

Prospect production

Creating airplane prospects is one of the purposes of our airport and flying school management course. By taking an active part in the operation of our school and sales agencies, students get not only the necessary experience but the desire to do likewise. They see our plan in operation, they sit in at sales conferences and follow the development of the sale from the inquiry to the check. They help in the selection of the new airport sites for new operators and watch the port develop. After their graduation it is only one short step to their own business. We do more than teach a man to fly and name the clouds. By exposing the student to the economic problems of flying service operation we develop the raw recruit into a finished operator.

Our biggest promotion job is to get the message to the masses that flying is within their reach. Radio talks, windshield stickers, department store displays, are a few of the ways that we have tried. Barber shops, the immemorial meeting places of youth, are among the best spots for the display of posters and the distribution of literature. Selling begins but does not end at home. An airplane distributor has much more to sell than planes and flight instruction. He must sell the department store manager on the increased business resulting from the presence of an airplane on his show floor, the radio station operator on the absolute necessity of a weekly fifteen-minute talk, the theater manager on the box office value of an airplane in his lobby.

If window space is too small for the whole ship the problem often can be solved by removing one wing panel and butting the wingless side against a wall or better still a mirror. The benefits to store owner and plane dealer are so evenly balanced that rarely is an exchange of cash necessary. When planes are displayed in windows, theaters, or hotel lobbies, carnivals, or department store interiors, a man should always be in attendance to talk to prospects and to get their names for mailing lists.

"Voice of experience"

On station WTNJ there is a feature called "Al Bennett's Weekly Airplane Chat." In this fifteen-minute broadcast I give advice to the flight fan and answer all aviation questioners. My inquisitors are perfect prospects and other members of the audience are of the finest material for sales effort. Thus our mailing lists purify and swell.

The opportunist can find many other ways of using the federal postal system to his advantage. During the recent Detroit Air Show I helped myself generously to the postcards in the desk of my hotel room and sent them to my prospects and my students. This little gesture did much to personalize our relations.

A year ago I would have thought our selling system suicidal. But we have discovered that, by helping others to make money, we make some ourselves.

Put your planes where people can see them. A Cub at the Capital during New Jersey's Safety Conference in September 1935

River Airport Problem

An architectural study of possible improvements to a New York City seaplane terminal

TO DESIGN a seaplane terminal building for the 31st Street Pier on New York's East River was the project recently completed by the Senior Architectural students of Pratt Institute in Brooklyn. Specifications called for a terminal to handle arriving and departing passengers and sightseers inspecting the station. TWA engineers discussed the arrangement and facilities with the students.

Requirements included: lounging room, 1,200 sq. ft.; ticket office to accommodate four airlines; map and weather room, 300 sq. ft.; radio room, 300 sq. ft.; manager's office 150 sq. ft.; newsstand, 80 sq. ft.; telegraph office, 25 sq. ft.; storage 150 sq. ft.; boiler room, 150 sq. ft.; restaurant—75 people; rest rooms; baggage space and telephones.

Seaplane ramp and mooring facilities are now available at 31st Street but provision for accommodation of passengers on the pier is somewhat limited. The floating ramp is of the type described in the January issue of AVIATION, page 4.

The 31st Street Seaplane Terminal as proposed. McLAUGHLIN AERIAL SURVEYS

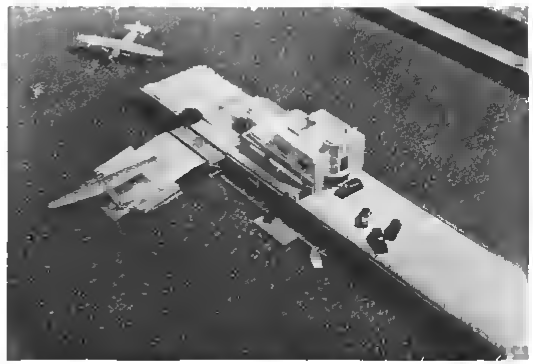


PHOTO BY PRATT INSTITUTE

First prize winner by Vincent Illia Jr.

PHOTO BY PRATT INSTITUTE

Second prize winner by Robert B. Brindley

Ridge Soaring Weather

Karl Lange served for a decade as meteorologist for the German Soaring movement. In 1931 he joined the faculty of the Massachusetts Institute of Technology to direct upper air research. This summer he was made research director of Harvard's Blue Hill Observatory. For the last four years he has given invaluable aid at the Elmira Meets of the American Soaring Society. He collaborates in this article on a subject of prime interest to all soaring devotees. It should also serve as an excellent working demonstration of the principles of atmospheric mechanics developed in the series of articles recently published here.

By Dr. Karl O. Lange
Research Associate at the Blue Hill Observatory of Harvard University

and Daniel Sayre
Assistant Editor of AVIATION

ANY discussion of the meteorology of soaring must start with a sorting out of the different types of atmospheric phenomena which can be used to sustain motorless flight. There are at least five distinct categories: winds rising over ridges; convection currents associated with cumulus clouds; dry thermal convections; the fronts between dissimilar air masses, and gusts. Each of them has undergone intensive study in the development of soaring technique, each sets up different sailplane design requirements, and each, may we add, has something of a lesson in it for the student of atmospheric mechanics.

There are other means of classification, of course. Some prefer to break the phenomena into two broad categories, mechanical and thermal. Many would omit our fifth class—horizontal gusts used for what is generally called dynamic soaring—because it has so far played only a minor part in soaring achievements. Sailplane pilots will immediately point out that many noteworthy flights have been carried out utilizing several different types of phenomena. There is not even a universally accepted terminology covering the subject. So be it. The following notes seem as simple in organization as can be combined with reasonable completeness.

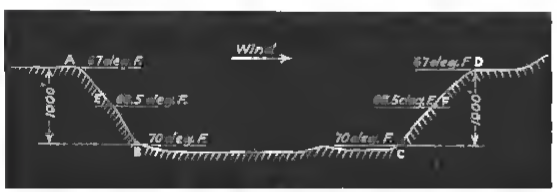


Fig. 1

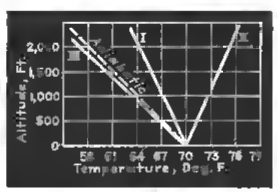


Fig. 3

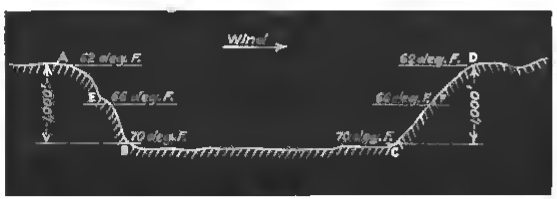


Fig. 2

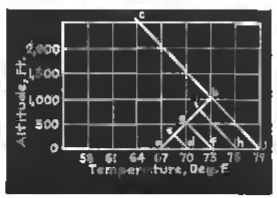
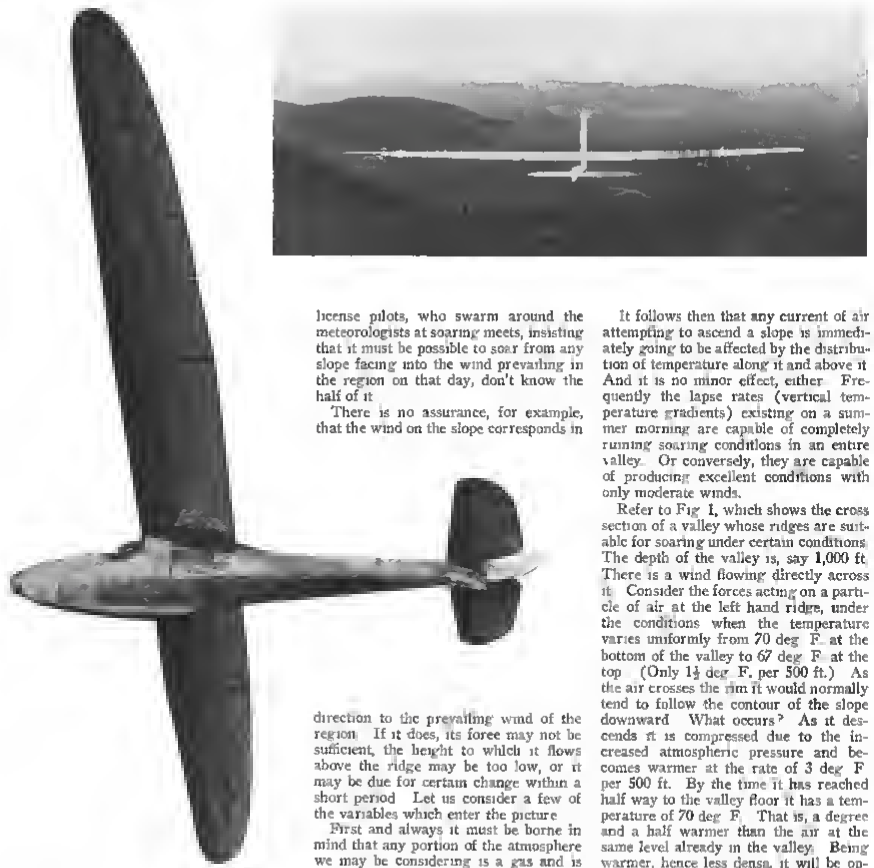


Fig. 4

The type of soaring we are concerned with in this issue is, of course, the most elemental of soaring situations, that of a steady wind flowing up the face of a directly opposing slope. If the force of the wind and the degree of the slope are great enough to produce a vertical component at least equal to the sinking speed of the sailplane, soaring becomes possible.

But the impatient spectators, and B-



license pilots, who swarm around the meteorologists at soaring meets, insisting that it must be possible to soar from any slope facing into the wind prevailing in the region on that day, don't know the half of it.

There is no assurance, for example, that the wind on the slope corresponds in direction to the prevailing wind of the region. If it does, its force may not be sufficient, the height to which it flows above the ridge may be too low, or it may be due for certain change within a short period. Let us consider a few of the variables which enter the picture.

First and always it must be borne in mind that any portion of the atmosphere we may be considering is a gas and is therefore subject to all the thermal and mechanical laws which govern the behaviour of a gas. Secondly it must be remembered that it is totally submerged in the rest of the atmosphere and is consequently as subject to the effects of atmospheric buoyancy as a balloon.

In recent AVIATION articles it has been developed that when air is raised, no matter what the mechanism, it will expand against the decreasing pressure and cool as it expands. Moreover since the ascending air has neither received nor lost heat from external sources during the process, its expansion is called *adiabatic*. Its rate of cooling, if unsaturated, is known from the gas laws to be 1 deg. C. for each 100 meters of rise, (3 deg. F. per 500 ft.)

It follows then that any current of air attempting to ascend a slope is immediately going to be affected by the distribution of temperature along it and above it. And it is no minor effect, either. Frequently the lapse rates (vertical temperature gradients) existing on a summer morning are capable of completely ruining soaring conditions in an entire valley. Or conversely, they are capable of producing excellent conditions with only moderate winds.

Refer to Fig. 1, which shows the cross section of a valley whose ridges are suitable for soaring under certain conditions. The depth of the valley is, say 1,000 ft. There is a wind flowing directly across it. Consider the forces acting on a particle of air at the left hand ridge, under the conditions when the temperature varies uniformly from 70 deg. F. at the bottom of the valley to 67 deg. F. at the top. (Only 1½ deg. F. per 500 ft.) As the air crosses the rim it would normally tend to follow the contour of the slope downward. What occurs? As it descends it is compressed due to the increased atmospheric pressure and becomes warmer at the rate of 3 deg. F. per 500 ft. By the time it has reached half way to the valley floor it has a temperature of 70 deg. F. That is, a degree and a half warmer than the air at the same level already in the valley. Being warmer, hence less dense, it will be opposed in its descent by a positive buoyancy, and will therefore tend not to flow down onto the valley floor at all.

Consider then another particle at *C* and assume it begins a flow up the hill. By the time it reaches F, 500 ft. higher, it will have lost 3 deg. of temperature and will be 1½ deg. colder than the air at the same level. Colder, hence denser, hence tending to sink back toward the valley floor.

Under such conditions the best one could hope for would be a very sluggish flow through the valley and up the opposite slope, even with a good horizontal wind across the ridges.

The "lapse rate" prevailing in the valley during our example is shown as line I in Fig. 2.

With the lapse rate II the forces opposing vertical movements would be even worse A great deal worse, for II represents an actual increase of temperature with increasing altitude And yet on mornings following clear nights, when the valley floor has had good opportunity to lose its heat by radiation such inversions are the rule rather than the exception Spanking horizontal winds at the crest of the ridge under such circumstances might well be coupled with dead calms in the valley and on the slopes

Lapse rate III (Fig 2) with the temperature falling more rapidly than 3 deg F per 500 ft is a different proposition At *A* (Fig 3) our particle would have a temperature of say 62 deg F As it reaches *E* it is one degree cooler, hence heavier, hence more liable than ever to continue into the valley When it reaches *F* from *C* it has become the same amount warmer, hence lighter than the air around it therefore more likely than ever to continue upward

Good ridge soaring then, to use nomenclature developed in previous issues, wants a steady wind flowing across the ridge, but it also requires an unstable lapse rate from the valley floor to some reasonable height above the ridge itself.

Unfortunately for the soaring meet weather staff, few morning lapse rates are ever as uniform and simple as the ones we have used in our illustration. And almost always, too, the vertical temperature structure changes constantly

Frequent variation is the presence of an *inversion*, that is, a layer of air in which the temperature actually increased with altitude, above a layer in which the drop in temperature is adiabatic or between the adiabatic and the isothermal And such an inversion acts as a discouragingly effective lid to any ascending currents beneath it If this lid occurs below the minimum useful altitude (crest height plus effective maneuvering space above it) there simply can't be any soaring of the ridge type

Frequent too, after a clear night as we indicated above, is the presence of an inversion beginning at the surface of the ground Fortunately these inversions are likely to be raised during a clear summer day by the effect of convection and turbulent mixing

This is illustrated in Fig 4 which shows an inversion starting from the valley floor in the early morning with a temperature of, say, 67 deg at the valley floor rising to a temperature of 73 deg at the ridge level then falling rapidly above that point As the sun heats the surface the bottom layers become intensely heated, tend to rise, and mix with higher layers producing progressively the lapse rates debc, fgbc, hibc, finally completely destroying the inversion at jbc Such action is helped greatly by wind at the lower levels no matter what its direction. Many a long afternoon has been spent at a soaring ridge waiting for the final conditions to be effected

Infinite, of course, are other possible variations under different combinations of ground temperature, cloud cover, wind, air mass involved, etc Different too are the effects at each site of the character of the surface and its cover, the angle at which the slope receives the morning and evening sun, local possibilities of land and sea breeze effects

Few general rules, therefore, can stand save this one There is more to the meteorology of ridge soaring than is told by the wind sock on the crest

Editorials

AVIATION

EDWARD P WARNER
Editor

Money for Airports

MANY months ago (and at frequent intervals since) we suggested editorially that there was no time like the present to look toward Washington for funds for the construction and improvement of airports. With 4 8 billions earmarked for relief projects under WPA the financing of legitimate airport development seemed to us to be a logical outlet for effective reemployment effort. Airport work is ideal in this respect, for it puts a maximum of available funds directly into the hands of labor, with a minimum going for materials and overhead. The list of projects which had been approved by WPA up to Sept. 10 (see page 50) indicates that allotments have already been made in some 25 states covering 141 separate aeronautical projects to a total of $7,220,000 To date, with the single exception of $4,800 for a wind tunnel at Seattle, all monies are assigned to the construction or improvement of airports. Individual sums range all the way from $144 for painting an office building on a South Carolina airport up to $1,240,000 for Los Angeles airports and $1,625,000 for improvements on New York's Floyd Bennett field Most active states in terms of projects approved are Florida with 43, Indiana with 16, Georgia 15, and Michigan and Minnesota with 9 each.

As we go to press comes report of another approval that completely overshadows any that appear on our list. An announcement was made on Sept 25 that the sum of $3,400,000 has been allotted for major improvements at Newark Airport. Plans call for rearrangement of hangars, enlargement in area, new drainage system, and extension of the main runway to 5,000 ft. An extensive program of landscaping will complete the job. Work is to be started immediately, and it is estimated that once in full swing, some 3,200-3,500 men will be employed.

Of the rest, the standing of Florida is perhaps the most significant. Her $916,000 fund is covering 43 projects in 40 municipalities from one end of the state to the other. In no case do they represent blind effort to take hasty advantage of available federal funds. The projects are all part of a long-range plan for the development of aviation in the state

Florida is one of the few states that has worked out a real aviation policy, a definite plan for its future. This year, Major A B. McMullen, director of the Aviation Division of the State Road Department and of the Florida FERA, not only presented to the state a complete report of past performances but outlined also a comprehensive ten-year plan for the development of Florida's aeronautical facilities.

California offers another excellent example. Under the leadership of B M Doolin as Airport Commissioner a state-wide survey of airport facilities has been made and a program for future development carefully mapped out. Already one of the most active states, aeronautically speaking, the recent trek of the industry to the West Coast renders some sort of long range planning more imperative.

Judging from the allocation of money in our table it is obvious that those states which have well developed programs for aviation, and who are represented by up-and-coming commissioners are the ones who fare best when their applications for WPA funds come up for approval. Even with $11,000,000 already allotted to airport development, there is no indication that other funds will not be forthcoming for the same purpose. At the moment some 23 states are missing from the list. It behooves everyone who is interested in the development of aviation within his state and in the United States as a whole to bring to the attention of state officials the fact that federal funds are now available for airport improvement. Herein is another and potent reason why each state should overhaul its aviation program and should set up a definite plan for future development under competent leadership.

Angels Wanted

ELSEWHERE in this issue is the record of the 1935 National Air Races, and, technically speaking, it is pretty sad. As a show for popular consumption the races were adequate, but their contribution to the aerodynamic art was nil. The designer of the year's outstanding winners sums things up rather neatly by saying, "When we can take 'Mike' built in 1932 to A T C. requirements, and a big, clumsy, four-place cabin job and make a grand slam in 1935 —there simply hasn't been any real racing development." The reason, he says, is not far to seek—

there's no money in it. He calculates that he would have to win both the Bendix and the Thompson three years running to break even on the cost of building and operating Mister Mulligan, and then the only profit would be a worn-out, three-year-old airplane. Not a very encouraging prospect.

The only hope of ever deriving further technical value from air racing lies in finding sponsors who are able and willing to underwrite the cost of developing new ships, or who can put up prize money adequate to encourage designers to produce new ships. Money makes the mare go, and the airplane, too. Witness Howard Hughes and his accomplishments. It is reported to have cost over $100,000 to build and fly the little one-place ship which has already set some astounding records. Within a few flying hours of its initial test it has brought the International land plane speed record back to the United States by a margin far and away in excess of F.A.I. requirements. At the same time it is reputed to have definite military capabilities.

It is to be seriously regretted that the Hughes ship did not appear at Cleveland this year. Perhaps its mere presence would have provided the stimulus toward a new and a real racing development in this country. We need a few more people (or groups) with both the enthusiasm and the money required to develop racing machines. With a half dozen starters in the Hughes class, the National Air Races could be made at the same time a marvelously exciting show and once more a real proving ground for the industry.

In Words of One Syllable

"Aviation people present impressive statistics proving how safe commercial flying is, but it is hard to judge aerial safety from these statistics because everything is figured out in passenger-miles. Planes fly so fast and go so far that a passenger-mile makes a dandy index for the company, but not such a good one for the passenger, who, though he may have been up only three times in his life, dies with 5,000 air-miles behind him to prove how safe it all was."—*The New Yorker*, Aug 31, 1935

TO the Editor of the *New Yorker:* You may well imagine with what fascinated attention we have read and re-read your views on air transportation as recently expressed. Though your conclusions fill us with astonishment, on at least one point you have our sympathy. Plainly a passenger-mile doesn't mean anything to you, and safety statistics in terms of that unit affect you like the statistics on the number of bacteria that inhabit a cubic centimeter of raw milk. They leave you unimpressed but unconvinced. We sometimes find ourselves falling into the same mood. A passenger-mile is like a light-year. It lacks physical form. It has no sex appeal. So let's turn it over to the statisticians, who love it, and talk together as plain men in plain language.

Suppose you lived in a village of 3,000 people. If they were average people, doing the average things, taking the average precautions of people who want to go on living, two of them would have been killed in automobile accidents so far this year, and two last year, and two the year before that. If it is a factory or a railroad town, there would have been other deaths, or at least serious injuries incapacitating your neighbor for further pursuit of his job. If it is in a hunting area the chances are strong that there will have been at least one didn't-know-it-was-loaded type of accident each year. Such things unfortunately happen, and we do what we can to prevent them, but we do not give up automobiling, nor pedestrianism, nor the use of firearms, nor the operation of factories or railroads because of them.

But now suppose that in one respect the town was far from average. Suppose that air transportation had the patronage, not just of a smattering of the up-and-coming leaders of the community as is the usual case, but of everybody in it, from the oldest down to the newest citizen. Suppose that everyone living there had flown the airlines, not just once, but in every one of the last three years. Suppose that the people of the town did the average amount of total traveling, but that they never used either railroad train or automobile, or anything except a transport airline, for any distance of over 200 miles. Under those circumstances (paradisiacal almost beyond the brightest dreams of air-line traffic men) the odds would still be better than even against any one of them having suffered serious distress of life or limb, or anything worse than annoyance due to an occasional cancellation on account of weather, at any time in the three years.

That probably surprises you. As a matter of fact, you probably think we're lying. But we're not, and we can prove it from the official records. Air transport five years ago was just about ten times as safe as you or most other people believed, and it's demonstrably just about ten times as safe now as it was then.

One other thing. You mentioned also your private list of air transport accidents "too bloody to publish, certainly too long." We would like to see it. Perhaps the airlines, the newspapers and the Department of Commerce have been concealing things from us that we should know about. As a part of our job we have been following the statistics rather closely, and have lately been working under the delusion that our airlines have gotten to be pretty safe. So safe, in fact, that we ride on them a great deal ourselves. If the *New Yorker's* intrepid little band of researchers has uncovered any evidence to the contrary, we should be very glad to have an opportunity of examining it privately, or of seeing it tabulated in the public prints.—The Editors of AVIATION.

Flying Equipment

Martin's Bomber

One of three entered in the Air Corps competition for improved bombing types.

New Martin Bomber in level flight. Chief interest here is in the position of the wing flaps which appear to be trailing behind the wing. With wheels down and with flaps extended, the ship is apparently coming in to land

ALTHOUGH bids were opened and prices announced (AVIATION, September, 1935), on the Air Corps' competition for new bombers, technical details of the three machines presented will be slow in forthcoming. Pictures and some data on the Boeing four-engine bomber have appeared in recent issues. Herewith a few notes on the Martin as released by the Air Corps.

Like the B-10 bomber (AVIATION, August 1935), the new machine is a mid wing, all-metal monoplane, powered with two radial air cooled engines. As a matter of fact, the new ship is very similar in external appearance to the B-10. At least its origin is plain, even to the most casual observer. It is purely and simply a bombing and fighting airplane. No consideration of subsequent transformation to a commercial transport has been allowed to influence considerations of military efficiency. Its normal crew is four or five. Its defensive armament consists of three machine-guns mounted to cover all angles of approach. The primary bombing load, as in all Martin bombers, is carried in a bomb bay amidships. A large hatchway in the underbody opens to discharge the missiles. Complete enclosure is provided for both front and rear cockpits. As usual, the bomber-machine gunner occu

Front and rear views of the new Martin Bomber. Similarity to the well-known B-10 type is obvious, although many of the details have been notably cleaned up. The landing gear is fully retractable. Power plants are Wright Cyclones, geared

pies the transparent "bird-cage" forward.

Little is known of the exact dimensions or specifications other than the span is 76 ft and the total weight loaded is approximately 10 tons. No data have been given out regarding performance, but it is a good guess that its top speed exceeds the required 250 m.p.h.

The power plants are two geared Wright Cyclones of over 800 hp. each swinging three-bladed Hamilton Standard controllable pitch propellers. Specified military equipment (besides the armament) includes two-way radio, automatic pilot and complete navigational equipment with radio homing compass.

Waco Fighter

Armed Model D delivered to the Republic of Cuba

AVERAGING 182 m.p.h. between the Troy factory of the Waco Aircraft Co. and the Military Airport at Havana, Cuba, a fully-armed military model of the Waco D was recently delivered to the Cuba Air Forces. The trip was made in a single day by Captain L. J. Povy and Lt. Manuel Orta of the Cuban Army.

The ship is substantially similar to other Model Ds described in prior issues of AVIATION. It carries as armament two bomb racks capable of handling ten 25 lb. fragmentation bombs. Three machine-guns are fitted, one in each of the lower wing panels well outside of the propeller disk, and one on a flexible mount in the rear cockpit. Instruments are fitted in both cockpits so that the ship may be used for training purposes as well as for actual combat work. Standard equipment includes landing lights, flares and instruments for night flying.

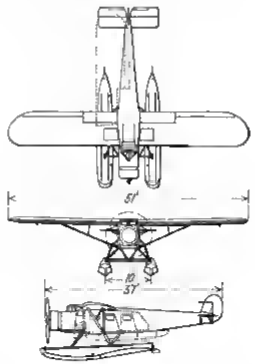
Power plant is the Pratt & Whitney Model SB Wasp Jr., a nine-cylinder radial engine rated at 400 hp. Propeller is a Hamilton Standard fixed pitch type.

For Backwoods Cargoes

Canadian Fairchild Company offers another freighter type designed for hard service in out-of-the-way places.

FEW PEOPLE realize how dependent many an isolated community in the far north is upon the airplane for its very existence. For years operators in Canada have been accumulating experience which is now being reflected in new designs turned out by Canadian manufacturers. The Fairchild Super 71 described in AVIATION for July of this year, is one example. The Fairchild Model 82 on which particulars have just come to hand, is another.

For far northern service, the high-wing, single engine monoplane on twin floats (replaceable by skis) is the commonly accepted formula. The Model 82 conforms to this specification. Also airplanes in the north must be prepared to accept any type of cargo that is offered. Wide cargo doors, clear cabin space, maximum accessibility are, therefore, prime factors, with considerations for passenger comfort taking definitely second place. In this report also the 82 is typical. Although it can accommodate from six to eleven passengers on either fixed or folding seats, its primary function is to handle cargo. Extra large doors, 42 in. high and 39 in. wide at the bottom have been installed on each side of the fuselage. The clear cargo space has a capacity of 180 cu.ft., is 15 ft. long, 4 ft. wide, 5 ft. 2 in. high. Although there is a bulkhead door available pilots do not have to climb back over cargo to get in and out of the cockpit. A large sliding hatch in the roof of the control compartment permits easy access to the top of the wing for refueling the wing tanks, for cranking or covering the engines, or for handling mooring lines when approaching a dock.



First of the new Fairchild 82s, delivered to Dominion Skyways, Ltd.

Military Waco. A fully armed Pratt & Whitney powered Model D.

Neat but not gaudy. The interior of Canadian Fairchild's Model 82 is readily adaptable to both freight and passengers. Regular passenger seating also available.

The fuselage is rectangular in section, is built up of welded steel tubes, fabric-covered. It is fitted with slinging lugs at the center section and with lifting handles at the tail. Special features are fittings along the underpart from which a canoe may be slung. Stationary tail surfaces are built into the fuselage, are also tubular steel framed, fabric-covered. Fin and stabilizers are adjustable on the ground only. Trim fore and aft is obtained from adjustable tabs in the elevators.

The wings are the Gottingen 387 air foil section. They are folding for easy storage. They are built up around spruce box bars and wooden ribs. Double drag bracing is fitted. The assembly is fabric-covered. Ailerons are of the Frise balanced type.

As a seaplane, floats are of the Fairchild Type 6000, all metal, extra wide track, with welded streamline tube attachment fittings. Edo water rudders are fitted. As a snowplane, special streamline ash skids with brass-covered runners are directly connected to long travel shock absorbing struts. Wheel type landing gear may also be applied if desired.

Power plant is a Pratt & Whitney T1D1 Wasp with Hamilton Standard fixed pitch propeller (controllable types may also be fitted). Eclipse hand inertia starter is standard equipment. Other accessories include booster magneto, stainless steel exhaust manifold, adjustable nose shutter and a special arrangement to supply hot air to the carburetor at sub zero temperature. Fuel supply is housed in two wing tanks (100 Imperial gallons total). An air-cooled oil tank (8 Imperial gallons) is provided, fitted with automatic thermostat control which reduces warming-up time in cold weather.

Seats for two are provided in the cockpit. They are arranged on sliding mountings and the controls are so arranged that the ship may be flown from either right or left-hand seat or from the center of the compartment if desired. Wheel or stick-type controls are optional. Cockpit windows are of shatterproof glass and the walls are sound insulated by means of Seapack.

Compartments are provided under the seats for anchor, tools and gear accessible from outside the ship.

All control cables are located overhead and are easily accessible. Hard cable good for the life of the airplane, is used throughout, except for about 8 ft. at the forward end of each control where flexible cable is used. The flexible sections are readily accessible for renewal when required. Ball bearing pulleys are used throughout.

General specifications include: span 51 ft. 0 in.; length overall 36 ft. 11 in.; height 16 ft.; float track 10 ft. 0 in.; ski track 9 ft. 0 in.; wing area 343 sq.ft.; weight empty (as landplane) 3,060 lb., (as seaplane) 3,465 lb.; gross weight (both types) 6,000 lb.; payload (landplane) 1,970 lb., (seaplane) 1,565 lb.

Performance: maximum speed, sea level (landplane) 150 m.p.h., (seaplane) 141 m.p.h.; climb in 10 min. (landplane) 7,600 ft., (seaplane) 7,030 ft.; absolute ceiling (landplane) 17,200 ft., (seaplane) 15,900 ft.

Poor Man's Plane?

McGaffey Aviate uses many automobile parts

A CURIOUS-LOOKING new airplane has lately been seen at Pasadena, Cal., product of the McGaffey Airplane Development Co. Marked feature is not only the use of a converted Ford V-8 engine, but also the use of Ford brakes, automobile racing tires, automobile type instruments and other parts readily available. Mass production possibilities have been the keynote of the design. The cabin is so laid out that it can easily be produced in any automobile body plant. Fittings, stampings and castings have been standardized so that one basic form has many uses.

The boom tail construction is unusual for a tractor. Both booms and tail surfaces are of stressed skin aluminum alloy construction. Wings are of wood and plywood construction with all drag loading taken in the skin. All other parts of the plane are metal. Landing gear and engine mounts are of steel tubes. The wheels and shock absorbing systems were designed by the builder.

Special features include wheel control, completely cowled-in landing gear, landing lights installed in the leading edge of the landing gear cowl, and the usual assortment of navigating and instrument lights. Starter and brakes are standard equipment.

The general specifications include: span 34 ft.; length overall, 23 ft. 9 in.; height, 7 ft. 1 in.; wing area (including ailerons), 195 sq.ft.; weight empty, 1,168 lb.; useful load, 583 lb.; gross

The Aviate Ford-powered product of the McGaffey Airplane Development Company of Pasadena, Cal.

weight, 1,750 lb.; wing loading, 9 lb. per sq.ft.; power loading, 18.5 lb. per hp. Performance testing has not yet been completed, but it is expected that high speed will show 115 m.p.h., cruising, 95 to 100 m.p.h., landing, 40 m.p.h. Rate of climb at sea level, 750 ft. per minute. Fifteen gallons of gasoline can be carried. With the motor burning 3 gal. per hour, the cruising range is five hours. Ordinary automobile gasoline and oil may be used.

Export Douglases

Hornet and Pegasus power plants installed for foreign service

Most common engines in Douglas DC-2 transports have been Wright Cyclones. Several of these machines which have lately been shipped overseas to foreign airlines, however, have been fitted up with other power plants.

K.L.M., Royal Dutch Airlines, has many Wasp and Hornet engines in service on older equipment, has taken delivery on the first Hornet powered Douglas. This machine is now in service on the 9,000-mile Amsterdam-Batavia run.

First attempt to fit foreign engines to the DC-2 was for the Polish Airline LOT for which two Douglases were delivered with Bristol Pegasus Mark III engines. Both ships were flown from Santa Monica to New York (the last one in just fifteen hours) for delivery by boat to Poland. The sale was made through the Fokker Company, which controls the Douglas sales in most of Europe.

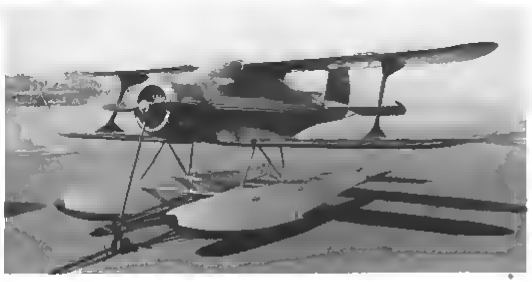
Performance with the Pegasus was reported to be much the same as that for the Hornet or the F-2 Cyclone. Some improvement was reported for take-off and climb, due to the greater horsepower available from the Pegasus at sea level. Although Poland has the license to build Bristol engines, the engines fitted to the Douglases were British built, imported through Canada.

Beech Plus Edo

Another Beechcraft Seaplane on Edo Floats

Last month we illustrated a Model B-17 Beechcraft (Wright Whirlwind 420 hp.) float-mounted for a round-the-world flight by Mr. Harold Farquahar of the British Diplomatic Service. Here is another conversion job, this time on a Jacobs (225 hp.) Model B-17L Beechcraft, mounted on a pair of Model 3430 floats with water rudders. It was recently flight-tested and granted an A.T.C. by the Department of Commerce off the College Point plant. Fully loaded (3510 lb.) she is reported to have gotten off the water in 30 seconds, to show a cruising speed of 130 m.p.h., a top speed of 142.5 m.p.h. As a five place seaplane the ship will carry 50 gal. of fuel, 75 lb. of baggage, and 74 lb. of miscellaneous equipment, including radio. For four people, fuel may be increased to 70 gal. Inggage to 125 lb.

Of special interest in the photograph is the Edo beaching gear which makes it possible to handle twin float seaplanes of all types out of the water.



A B-17L Jacobs powered Beechcraft on Edo floats.

Recent Douglas deliveries abroad have included a Hornet powered DC-2 for K.L.M. A Bristol powered ship for Poland.

Antenna Reel

An automatic type for trailing wires types

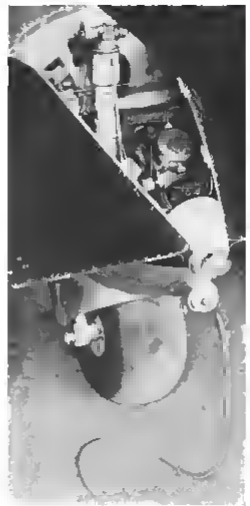
From an electrical standpoint the trailing wire antenna for aircraft radio sets has much to commend it. It is usually possible to get considerably more electrical output from a trailing wire than from the more common fixed type of antenna. Mechanically, however, it has disadvantages. It is always a nuisance, sometimes a hazard, when the airplane is on the ground, and (especially for high speed ships) while in flight, the whipping of the trailing wire causes frequent breakage, requires frequent replacements. Fixed trailing wires are sometimes damaged in electrical storms.

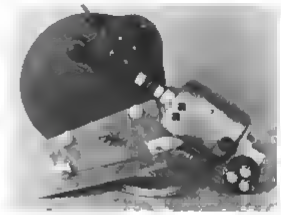
To retain the advantages and to eliminate the drawbacks, Heintz and Kaufman, Ltd., of South San Francisco, Cal., have lately put on the market an automatic, electrically operated reel designed to feed out and to rewind a trailing wire antenna in flight under push button control from the cockpit. Two types are available (1) a two-position type which carries the wire either all out or all in, or (2) a multi-wave control type which permits any length of wire to be paid out at will to permit changes in transmitting frequency. An indicating dial mounted near the pilot shows the length of wire trailing at all times. High electrical efficiencies may be obtained from the adjustable type, for frequency changes may be made without the need of antenna loading devices.

Reels hold 150 ft. of antenna wire, are driven through a ball-bearing mounted worm gear from a small electric motor. A number of safety features are incorporated, including automatic stops to prevent the wire from running completely out of the reel or from being drawn too far into the reel when the end is broken off. With the multi-wave type, if the wire breaks the correct length for a given frequency will still be fed out every time and the indicator in the cockpit will indicate correctly as long as there is any wire left.

An antenna stabilizer (or rubber "eel") has been designed for attachment to the free end of the trailing wire to eliminate wire whipping and breakage. This is simply a very flexible piece of tapered rubber, attached to the end of the wire, and having practically no weight (2 oz.). The antenna stabilizer and special feed-out bushings are both supplied as standard equipment with the antenna reel unit.

The antenna reel proper is approximately 5x9x12½ in., weighs 6 lb., and is operated by a 12 volt, 12 amp. motor. The feed-out insulator assembly combined with an automatic stop switch, weighs approximately 1 lb. One hundred and twenty-five feet of antenna wire weighs 1½ lb. As for the control, the single wave type (all out or all in) weighs 2½ lb. The multi-wave type (with frequency control selection) weighs 3¾ lb.





Above: The Heintz & Kaufman automatic aircraft antenna reel. Left: Automatic antenna reel installed in the tail of a Vultee transport. Note the rubber antenna stabilizer.

Leo Werrender of the Casey Jones School inspects the experimental belt drive installation.

Belt Drive Experiment

Casey Jones School investigates possibilities of Vee-belt for propeller drives

Belt drives between engine and propeller (not only to effect speed reduction from crankshaft to propeller shaft but also to break up the fixed relationship between engine and propeller necessitated by conventional practice) have been subject to investigation for some time recently by students and faculty of the Casey Jones School of Aeronautics at Newark, N. J. Tests were run not only to determine the effectiveness of belt drives but also to test the behavior of a stock automobile engine under aircraft operating conditions over an extended period of time. A complete report on both phases of the experiment is available through the Department of Commerce (Air Commerce Bulletin Sept. 15). An abstract of those parts of the report which deal directly with the mounting and behavior of the belt drive, is given here for the benefit of designers interested in unconventional engine and propeller arrangements. The results seem to be of sufficient interest to warrant considerable further research.

The engine used was a standard six-cylinder, water cooled, 100 hp. Terraplane motor manufactured by the Hudson Motor Car Co. No changes or alterations were made, standard starter, generator and ignition systems being used throughout the test. It was mounted low in a wooden frame (with front end mounted rigidly, rear end on rubber) and installed in an open shack at the Newark Airport. The front of the engine, the pulleys, belts and propeller were outside the building. Thus the test was conducted under extremely unfavorable conditions as most of the apparatus was exposed. It was run in all kinds of weather, including rain and high temperatures. Also, as the propeller was mounted as a tractor, the belts and engine were in the slip stream and were constantly deluged with dirt, dust and oil.

The pulleys were mounted on 5 ft. centers. The lower pulley was attached directly to the ring gear of the engine and supported externally by a Hyatt bearing to permit end play of the crankshaft. One half of a Fledgling landing gear was used to support the upper pulley and propeller, which were mounted on Timken bearings to take the propeller thrust and drive load. Experiments were made with and without idler pulleys, and with one idler only on the slack side, but because of the length of the belts, two idler pulleys (turning approximately 8,000 r.p.m. on Fafnir ball bearings) attached about midway up the belts proved most effective. With shorter drive these could probably be dispensed with.

The belts were manufactured by the Manhattan Rubber Co. of Passaic, N. J., and are standard for general industrial purposes. From one to six belts were used. They proved particularly adaptable for the work as the load is taken

by nine woven strands in the middle of the belt, each capable of taking a load of 100 lb. The rubber fabric casing is used only as covering and to give effective driving surface. This type of belt breaks from the outside in and gives ample warning (detectible through visual inspection) long before the breaking point is reached.

The pulleys were made of cast duralumin, machined to fit the belts. No effort was made to reduce the weight for this particular test. The lower pulley showed decided wear before 100 hours and was replaced by a steel pulley which showed no signs of wear during the balance of the test. The upper pulley, which was about twice the diameter of the lower, completed the run, but, at the end, showed decided wear. It seems likely that steel pulleys must be used on both ends.

The test was run for 300 hours, 60 hours at full throttle, the balance at approximately 70 per cent of power. The Terraplane engine develops 100 hp at 4,000 r.p.m. and it was run from 3,250 to 3,800 r.p.m. The pulley ratio used gave approximately 1,600 r.p.m. on the propeller at full throttle. This varied somewhat, due to the wear on the pulleys and the fact that ratio was changed slightly when the lower steel pulley was substituted. During most of the test a wooden propeller, manufactured by the Fahlin Propeller Co., Marshall, Mo., was used. This propeller was designed for the 125 hp. Kinner engine and consequently did not turn quite up to maximum speed. The engine power curve between 3,600 and 4,000 r.p.m. is very flat, however, and at full throttle the engine was developing approximately 100 hp. A club test propeller used for short times gave engine speeds of over 4,000 r.p.m.

Several wide open runs of two hours each were conducted using one, two and four belts. It was observed that with one belt the slippage was about 13 per cent, with two belts, about 10 per cent; four belts, 5-6 per cent, and with the six belts, less than 3 per cent. Slippage was determined by taking comparative readings from two tachometers, one on the engine and the other on the propeller shaft, through the range from low speed to high. It is recognized that this method is not entirely accurate, but on the other hand, it must be remembered that, as the speeds and power loads increase, the belts are pulled more tightly into the grooves, thus reducing the ratio, so that it is very difficult to determine the exact slippage. In any event, the slippage with six belts was surprisingly small.

In the early stages of the test, the belts showed some stretch and it was necessary to increase the distance between the pulleys to correct it. These adjustments were necessary after about twenty hours of running, but during the last 200 hours, no adjustments were required. The belts gave no difficulty, showed slight signs of wear at the completion of the 300 hours, and would have given at least another 100 hours of service, according to expert opinion.

With Foreign Builders

A miscellany of sport types from here and there, a few transport notes, and two large flying boats

Whatever else is known about aviation development in Russia, one fact is clear. Soviet aeronautical engineers have not let preconceived ideas stand in the way of their trying out new and unusual forms of aircraft. Two such have been picked up lately from the Soviet news photo services. Unfortunately, there is very little in the way of descriptive material to go with the photographs beyond what can be seen with the naked eye. More unusual of the two is the LK-1, a five-place passenger ship with a single five-cylinder engine which, we should judge, might be good for 150 hp. Most notable feature of the machine, however, is the use of the airfoil type fuselage (Barnelli and Bellanca have been chief proponents of the idea in this country), and the very thick, highly-tapered wing. Trailing edge flaps are also visible.

The Miles Merlin five-seater from England.

Czechoslovakia's Praga Baby.

Other example is the three-seater "Leningrad Young Communist" designed at the Leningrad Institute of the Civil Air Fleet. It appears to be conventional enough except for the vertical fin area on each wing-tip. The landing gear is obviously retractible. Evidently some of the landing gear fairing was missing when the picture was taken.

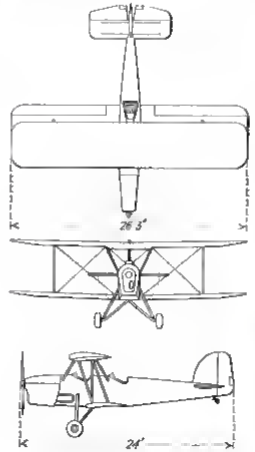
Trim low-wing monoplane "pour le tourisme," or for airline feeder service, is the latest Miles Merlin manufactured by Philips & Powis Aircraft Co., Ltd., of England. Power plant is the Gypsy Six of 200 hp. Latest machines are a development of the type originally built for the Tata Co. for air mail service between Bombay and Colombo.

From Czechoslovakia comes the Praga Baby, a light sports type for two. Seats are arranged side-by-side. Span is about 35 ft., length 22 ft. The engine is a horizontal two-cylinder opposed type developing 36 hp. at 2,400 r.p.m., is strikingly similar in appearance to our own Aeronca. This machine is built to sell for about $1,200.

Two from Russia. Above: The L.K.1 five-seater with airfoil type fuselage. Below: The "Leningrad Young Communist" conventional enough in appearance except for the fin area on the wing-tips.

From lessons learned from its racers (Coupe Deutsch de la Meurthe, Delmotte's speed trials, etc.) Caudron of France has turned out a four-place cabin monoplane powered with a 195 hp. Renault engine. The Caudron C-620 is a clean-cut low-wing monoplane with fixed landing gear, built mostly of wood, with a reported top-speed in the neighborhood of 180 m.p.h.

Popular as a training machine at the Dutch National Flying School is the Koolhoven F.K.46, two-place tandem biplane. The ship may be rigged with open cockpit (small windshields) or with a complete transparent enclosure for both cockpits, which makes it useful also as a light touring plane, or for blind flying instruction. Construction is conventional throughout. The fuselage is of welded steel tubing, the wings are entirely of wood with spruce spars, plywood ribs and plywood covering. Interplane bracing is of the N type with all bracing wires in one plane. Fin and stabilizer are also of all-wood construction. Rudders and elevators have welded steel framing are fabric-covered. Trimming is obtained by flaps which may be controlled from both cockpits. Landing gear is of a straight-forward tripod type with oleo shock absorbers. Wheels are fitted with brakes and low pressure tires. The power plant is a Gypsy Major inverted air-cooled engine on a simple and rugged mount which is easily accessible for inspection and repair. Empty weight is 1,166 lb., gross, 1,650 lb. Top speed 110 m.p.h.



Koolhoven's F.K.46 trainer.

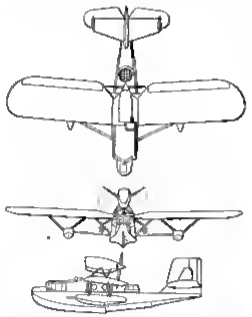
Transports large and small

Large transport types are tending to reduce themselves to a common formula the world over. Italy's latest, the Caproni 123, could be described in practically the same terms (as far as external appearance is concerned) as our own Douglases, the French Wibaults, and the British Bristol transports. Chief variation in this case is the use of a fuselage deep enough to permit a passenger cabin on two levels. The cockpit, including space for two pilots and a radio operator, is high up in the nose section and a front compartment with space for eight passengers is on the same level. At about the rear wing spar, however, the floor level drops down to the lower part of the fuselage for a second compartment seating twelve. Comfortable seats, full soundproofing, complete heating and ventilating systems are features. The engines are Gnome Rhone K-14 of 880 hp. each. Top speed is said to be about 210 m.p.h.

The Bristol Type 142 (referred to above) is shown in another photograph coming into land with both wheels and flaps down. It is powered with two Mercury engines of a maximum of 645 hp. each, is said to have a top speed of 268 m.p.h. at 16,000 ft. It is built entirely of metal, including the framing and the covering. The Air Ministry has ordered a number of this type con-

verted for use as medium bombers in the Royal Air Force.

In the lighter transport field, the deHaviland Dragon is still being built in some numbers. Details of this machine were first described in AVIATION for June, 1934. The latest type (and incidentally a machine which has been delivered to the Prince of Wales for his own personal use) is shown in an accompanying photograph. The power plants are the deHaviland Gypsy VI.



For naval patrol service, the French Loire 130

Marine types

In recent months France has turned out a number of large flying boats of considerable interest. The CAMS 110 is the largest of the lot. A product of the Societe des Chantiers Aeromaritimes de la Seine, it is a large single-hulled biplane powered with two engines, one pusher and one tractor, mounted in an interplane nacelle amidships. The engines are highly supercharged Hispano-Suiza 12 Ybrs. The ship is reported to have a top speed of over 135 m p h. at the critical altitude of its engines, and to have a range of better than 1,200 miles with over a ton of bombs. Four machine-guns are provided for defense.

A smaller French flying boat of the patrol type is the Loire 130. This is also a single-hulled type, but a monoplane, and powered with but one engine, a Hispano-Suiza 12 Xbrs of 720 hp mounted as a pusher in an overhead nacelle. It is credited with a top speed of better than 145 m p h, carrying a useful load of 1,600 lb exclusive of fuel.

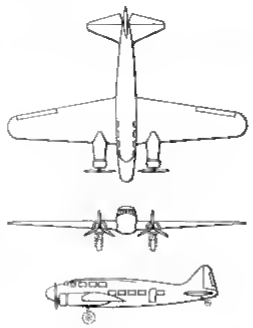
A Correction

Pratt & Whitney power on Dr. Light's Bellanca.

THROUGH error it was stated on page 31 of AVIATION for September, 1935, that the Ballanca Skyrocket De Luxe recently delivered to Dr. Richard U. Light of New Haven, Conn., was powered with a Wright Whirlwind of 420 hp. Actually, the engine in the machine as delivered to Dr. Light was a Pratt & Whitney Wasp.

Transport or bomber, the Bristol (England) Type 148

France long-range naval bomber the CAMS 110



Italian transport, the Caproni 123

A Dragon, recently delivered to deHaviland for the Prince of Wales. Widely used for light transport in England.

Operator's Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 9: How have you solved the ground transportation problem in your operation? Have you made arrangements for special rates with bus or taxi companies or do you provide service with cars of your own? Is the transportation between airport and city included in charges for charter service or is it collected separately? Do you charge students without cars for transportation to and from the field, or is the expense absorbed in some other way?

Plenty of transportation

GROUND transportation has never been a problem with us. The majority of the students have their own cars, a bus line runs by the field, and a taxi service is constantly available at the terminal. Consequently we have never found it necessary to offer our students any special transportation service.—JOE PLOSSER, *President, Grand Central Flying School, Glendale, Calif.*

Bus lines handy

IT IS quite unnecessary for us to provide ground transportation because the bus lines come within easy walking distance of our port. However in some cases we do pick our students up at the end of the bus line and take them back on completion of their lessons. This is not a general practice however and often the car used for the purpose is that of the pilot or even one of the students. In the event that we did establish a regular service of the above type, we would not make a charge to the student but probably absorb the small cost in the overhead expense of the flying school.—J. GRANT MCDONALD, *Dycer Flying Service, Dycer Airport, Los Angeles, Calif.*

Question Never Raised

OUR present arrangement with cab companies and with the operation of company cars, the subject of transportation between airport and the city on charter trips has never been brought up, therefore, we have never assumed such charges. We are not engaged in any student instruction.—F. W. WHITTEMORE, *Vice-President Northwest Airlines, Inc., St. Paul, Minn.*

Extra Cars Provided

OUR airport is situated about 3 miles from the center of town, the nearest bus line being 1 mile distant. Up to the present we have solved our transportation problem very simply by keeping an extra car or two available for visiting pilots. To date there has been no charge for this service, the thought prevailing, however, to maintain a "drive yourself" service if the traffic got much heavier. Too little consideration has been given this condition. Many people would fly more provided adequate transportation facilities were available at the airport.—L. U. EVERLY, *President, Everly Aircraft Corporation, Salem, Ore.*

Free Bus Service

WE have solved the problem by donating bus service to and from town for visiting flyers.—BEN TORREY, *Corning, Calif.*

*

QUESTION 10: How do you compute operating costs of the various types of aircraft used by flying school operators? What cost factors do you use? On what basis do you compute depreciation of equipment? (Submitted by Edward A. Dycer, Manager, Dycer Flying Service, Los Angeles, Cal.)

How Grand Central Does It

OPERATION costs are computed at the Grand Central Flying School monthly by adding together gas, oil, maintenance, depreciation, overhaul, reserve and hangar storage charges and dividing by the number of hours flown. The record of each airplane is kept separate. Gas and oil consumption for each type is relatively constant, therefore the hourly charges for these items are likewise constant. A full time mechanic is employed to service all the school's planes so that the maintenance cost is obtained by charging each plane a proportional amount of the mechanic's salary according to the amount of time the mechanic spent on each plane.

Depreciation charges are obtained from a formula that writes the airplane off the books in 2,000 hours. This charge is therefore constant for each airplane of a given value and is given per flying hour. An overhaul fund is obtained by charging $1 an hour to equipment powered with 100 or 125-hp engines and 50 cents an hour to equipment of lighter horsepower. Fifty cents per hour is charged to each airplane for a reserve insurance fund, the school carrying its own fund for this purpose. Hangar storage charges are constant each month, varying as an hourly charge against each airplane according to the amount of time each airplane flies.

Inasmuch as the school's income is derived from several sources other than flying the overhead charges are met a little differently than those of the ordinary flying school. The profit obtained from the various activities of the school is placed in a general gross profits fund. From this fund salaries and other overhead expenses are paid. As an example, the extra amount of money received for flying instruction as compared to solo flying, is placed in the general fund. In turn, the instructors who are paid on a monthly salary basis, are paid out of this fund.—JOE PLOSSER, *President, Grand Central Flying School, Glendale, Cal.*

Question 11

(Answers will be published in December)

DO you find much interest in college student flying in your community? What proportion of the students in school or college may be expected to be prospects for flight instruction? Have you made any attempt to sell the local educational institutions or their student bodies on the benefits of collective or individual flight instruction? If so what were the results? (Submitted by J. F. Donovan, Manager, Associated Air Services, Ltd. Palo Alto, Cal.)

Question 12

(Answers will be published in December)

WHAT do you do to get the public cool to your airport? What methods such as air meets, radio broadcasts etc. have you employed for this purpose?

Pro-Rating from Twelve Months

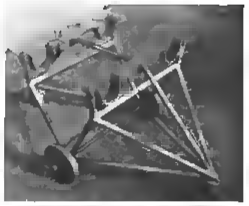
WE compute our operating costs on flying school equipment by the gas and oil consumption per hour, the hangar rent per hour, an arbitrary figure per hour for major overhauls and routine engine maintenance, and base the depreciation by pro-rating from twelve months the difference between the present worth of the airplane and the figure which in our opinion will be the probable worth of the airplane one year hence.—W. W. KRATZ, *President, St. Louis Flying Service, Inc., Robertson, Mo.*

The Maintenance Notebook

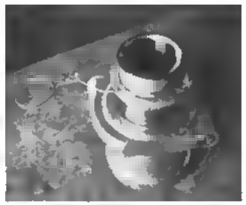
For the Propeller Shop

TWO items seen in United Air Lines' maintenance shop at Cheyenne might prove useful to propeller maintenance men elsewhere.

As United Air Lines has now re-equipped all its routes with the Boeing 247D, which normally mounts three-bladed Hamilton Standard propellers, the handling truck shown in the accompanying photograph has had to be abandoned in favor of a larger one to handle the three-way type. For those who still have two-bladed propellers among their equipment, however, the photograph may furnish an idea. The truck is built entirely out of aircraft tubing and flat scrap iron, welded up. The saddle for the two propellers may be covered with leather or felt to prevent damage to hubs. The two main wheels are at a slightly lower level than the two smaller wheels, so that the truck rests on three points only at all times and is therefore very easy to push about.

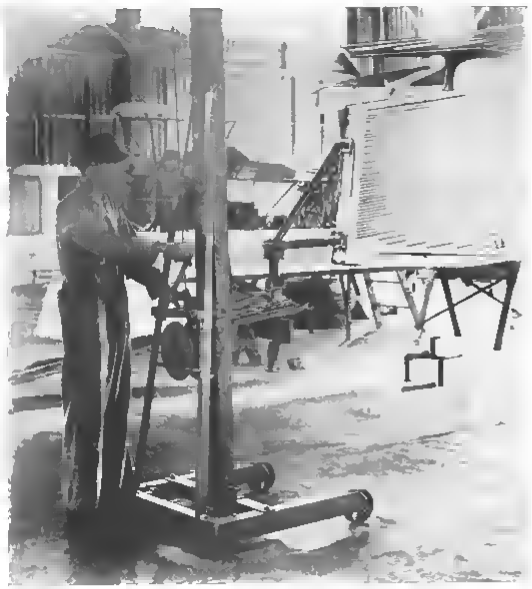


A dolly for handling a pair of two-bladed propellers.



A bent wire makes a simple tool for use in assembling controllable hubs

The other item is a very simple one, a tool made up out of a piece of fairly heavy gage steel wire. Its use for holding the washer in place during assembly of controllable pitch propeller hubs is plainly indicated in the photograph.



A special fixture applied to a portable hoist facilitates rigging airplanes in Pan American's Brownsville shops

Safety Screen

PRESSURE gages under calibration at high pressures sometimes have an unpleasant habit of failing suddenly and distributing themselves about the test room with some velocity. To protect instrument men at United Air Lines' shops at Cheyenne, a panel of safety glass has been mounted in front of the gage testing equipment. The operator can watch the face of the dial through the glass and at the same time be protected in case anything lets go. Enough clearance has been left between the panel and the pressure manifold to permit convenient mounting and coupling up of the instruments under test.

New Use for Hoist

HOISTS of the type shown in an accompanying illustration have a variety of uses around an airplane overhaul shop. Readers of this department will recall that a very similar hoist was used for a long time at Eastern Air Lines' old shop in Atlanta to install engines in airplanes. Here is a new use, an application made in the Pan American maintenance shops at Brownsville. In the photograph the hoist is being used to handle the tail end of a Ford tri-motor. A simple fixture has been made up to fit into the tail wheel hinges on the tail post. The same arrangement could be used on almost any airplane, changing the design of the attachment fixture to suit. With the hoist it is an easy matter to raise or lower the airplane through small distances to adjust it accurately to flying position during overhaul.

One of the Braniff Airways fleet of Lockheed "Electras." They fly 9,000 miles day and night.

15 MILLION MILES OF *flying experience!*

The *extra* margin of safety—speed—economy *proved* by one of the world's fastest air transport lines.

Braniff Airways—known as the "B" Line—is the outgrowth of more than 15,000,000 miles of operating experience.

This experience recognizes that the choice of dependable fuels and lubricants is of paramount importance. Texaco "gas, oil and grease" are used by Braniff Airways—as well as many other leaders in aviation—because of their proved dependability for all types of ships and under all flying conditions.

Texaco Aviation Products are available at all ports throughout the country. Texaco dealers and representatives know ships and engines. You will find them friendly, and alert in their cooperation toward making your air travel safer, faster, more economical.

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★

Proof of the superiority of Texaco Aviation Products is being demonstrated daily in all fields of aviation. Convincing evidence of this is the fact that with countless brands from which to choose, "TWA," "Bowen," "P.A.T.," "Northwest Air Lines," "Delta Air Lines," and many other leaders in commercial aviation, standardize on Texaco.

THE TEXAS COMPANY ★ 135 East 42nd Street, New York City

TEXACO AIRPLANE OILS ★ TEXACO AVIATION GASOLINE ★ TEXACO MARFAK ★ TEXACO ASPHALT PRODUCTS FOR RUNWAYS, HANGAR FLOORS, APRONS AND DUST LAYING

TEXACO *Aviation* PRODUCTS

THERE IS AN EXTRA MARGIN OF SAFETY, SPEED AND ECONOMY IN TEXACO AVIATION PRODUCTS

News of the Month

★ ***Records*** . . . **Howard Hughes sets new land plane mark of 351.79 m.p.h. . . . Major deSeversky breaks all amphibian speed records at Wayne County meet . . . Laura Ingalls breaks women's transcontinental records, comes within a few minutes of best men's non-stop time.**

★ ***Transport*** . . . **Tomlinson flys DC-1 in new tests toward stratosphere operations . . . American Airlines orders fifteen Douglas sleeper transports . . . United completes replacement of fleet with 247-D's on transcontinental route.**

★ ***Army and Navy*** . . . **Navy masses 416 planes in demonstration over San Diego, as fleet parades . . . Naval aeronautical engineers relieved of sea duty.**

★ ***Industrial*** . . . **Vidal issues specifications for small transport as part of aircraft development program . . . Bureau reports on belt drive tests . . . Aircraft production for first six months 14 per cent ahead of last year . . . Waco and Taylor report capacity production.**

★ ***Financial*** . . . **Fairchild, Sperry, and Irving Air Chute report six months profit . . . Waco and North American suffer small losses.**

★ ***Airports*** . . . **WPA releases list of airport projects that have been finally approved. Total $7,220,000 by Sept. 10.**

★ ***Lighter-Than-Air*** . . . **Two Polish entries first and second in Gordon Bennett Race . . . Russians report two record breaking flights.**

★ ***Foreign*** . . . **Flt. Lt. Tom Rose wins King's Cup Race in Miles Falcon. Mew Gull breaks 200 m.p.h. in fastest laps in Race's history.**

"Our Wings Grow Faster"

Important new landplane, amphibian, and women's marks feature the month.

AS THOUGH inspired to make amends to the public for the low speeds that won the National Air Races, three American record breakers went on the offensive last month.

Howard Hughes' record breaking was the most important from an international viewpoint. Six times, on the 13th, he put his tiny Twin-Row-Wasp-powered racer over a 3-kilometer course at Santa Ana, Cal. While turning for the seventh dash his main tank ran dry. Hughes switched to the reserve but the engine would not catch. A forced landing in a nearby beet field did no injury to the pilot but wiped off the landing gear which had been in the half-way retracted position at contact.

The accident hardly marred Hughes' day. N.A.A. timers had clocked him at 351.79 m.p.h., over 35 m.p.h. faster than the 314.32 set last fall by Raymond Delmotte of France. Repairs were expected to restore the racer quickly to condition for further dashes—Hughes believes it capable of 365 m.p.h.—and for an attack on Col. Roscoe Turner's ten hour transcontinental mark.

On the fifteenth Major Alexander de Seversky drove the speed record for amphibians upward from the 191 m.p.h. mark, set a few months ago by Lieut. E. G. Stone of the Coast Guard, to 230.03 m.p.h. His fastest dash across the 3-kilometer course at the Wayne County, Mich. airport was clocked at 235.96 m.p.h.

Earlier, Laura Ingalls had flown her Lockheed Orion non-stop from Los Angeles to Floyd Bennett Field, Brooklyn in the splendid time of 13 hours and 34 minutes—3½ hours under the former woman's West-East mark set by Amelia Earhart two years ago—only seven minutes short of Frank Hawks' non-stop record for men. Confusion between radio beam courses over Columbus, Ohio was the only incident to slow her record. Miss Ingalls estimated that cost her a half hour and the chance to break the Hawks record.

• Howard Hughes has been flying airplanes fourteen of his 30 years. At the age of twenty he inherited an income, estimated at $2,000,000 a year, from an oil well tool business and oil land holdings in Texas. A year later he was backing his own movie productions in Hollywood. Two years later he was directing the combat scenes of "Hell's Angels" from his own airplane. Even in Hollywood his good fortune he'd. He sunk $4,000,000 in "Hell's Angels," building a half scale airship, combing Europe for authentic Fokkers and other

FASTEST transcontinental flight by a woman was made Sept 11 by Laura Ingalls. Time: 13 hours and 34 minutes. Ship: A Lockheed Orion with an 810 Wasp

war-time ships Half way through it, he had to go back and add sound-effects, just then coming into fashion. But "Hell's Angels" is estimated to have brought him back at least $7,000,000. And "Scarface" and "The Front Page" have also been heavy money makers. Hughes kept up his flying. He has owned a whole fleet of planes at one time or another. A year and a half ago he set engineer Richard Palmer and a crew of workmen to the task of building a racer. Estimates of its cost run as high as $150,000.

• Laura Ingalls first soloed at Roosevelt Field in 1928. The next year she entered the Universal Aviation School in St. Louis, graduating as a transport pilot. Small, curley-headed, she had once done four-a-day vaudeville turns, then worked as a secretary at New York's Metropolitan Museum of Fine Art. In 1930 she set up consecutive stunting "records" of 980 loops and 714 barrel rolls. In the same year she placed third in the Women's Dixie Air Derby and set women's transcontinental records: Westward 30 hours 27 minutes, Eastward 25 hours 35 minutes. Last year she completed a 17,000 mile solo circuit of South America that included the first solo flight by a woman across the Andes. Three times this year she attempted to lower the Earhart mark in the new black and silver Lockheed she has named Auto-da-Fe—act of faith. A dust storm forced her down in Colorado in April. Engine trouble halted her in Indianapolis a few weeks later. Then in July she made the first East-West nonstop transcontinental flight by a woman, but her time was still much slower than the Earhart mark which had been made from West to East. To recent interviewers she has mentioned plans for (1) another transcontinental dash after Hawks' record (2) A flight across the Atlantic (3) A flight across the Pacific via the new Pan American bases.

• Twenty-one year old Alexander deSeversky joined the Russian Naval Air Service in 1915. Within a few months he had been shot down while attacking a German destroyer and lost a leg in the process. The next year he returned to action as a pursuit pilot, soon rose to command all pursuit groups in the Baltic Sea region. By the end of the War he had personally shot down thirteen planes. Even during this war activity he began designing aeronautical equipment. Late in 1917 he was sent to this country as vice-chairman of an aviation mission.

Stranded here by the Revolution, deSeversky became a test pilot later a consulting engineer for the Army Air Service. In 1921 he organized the Seversky Aero Corp. to develop his designs and inventions. In 1933 his first amphibian shattered speed records in its class. Last winter his firm won an Air Corps contract for 30 high speed training planes. He has a pursuit plane now waiting evaluation at Wright Field.

FASTEST

three kilometer straightaway dashes in an amphibian were made Sept. 15 at Detroit by Major Alexander deSeversky. Best four consecutive dash average: 230.65 m.p.h. Ship: A Seversky SEV-S with an 1820-82 Cyclone

FASTEST

three kilometer straightaway dashes in a landplane were made Sept. 13 at Santa Ana, Cal., by Howard Hughes. Best four consecutive dash average: 351.70 m.p.h. Ship: A specially designed Hughes racer with a Twin Wasp Jr. engine.

Cleveland Forever

1935 races report handsome profit. Cleveland wins another five year assignment.

SEPT. 20, Louis W. Greve, president of the National Air Races of Cleveland, Inc., announced that the 1935 meet had been the most profitable on record. Expenses, including a reserve fund for next year of $15,000 amounted in round numbers to $204,000. Income was $270,000. Profit $66,000.

On the same day came news that the National Aeronautical Association had extended the Cleveland contract for another five years with this proviso: that the N.A.A. may assign the races to another city in two of the five years, but not consecutively, on eighteen months notice to the Cleveland organization.

For King and Cup

Fourteenth annual British classic a Miles triumph.

ONCE A YEAR, sporting Britishers wheel out their ships for a three-day trial of speed and efficiency in competition for the King's Cup. Events consist of elimination and qualifying contests, a circuit-of-Britain race (over a 950-mile

course that this year touched Scotland, Ireland and Wales and involved two over-water jumps) and a final speed race, (six laps around a closed triangular course for a total of some 350 miles). D H Gypsy powered Miles airplanes swept the board, with Flt Lt Tom Rose taking first place (at 176.3 m.p.h. in the finals) on a Falcon Second was Flt. Lt Edwards on a Hawk Trainer; third, O Calheart-Jones, also on a Hawk Trainer Outstanding speed performance went to the scratch machine, a Percival Mew Gull (Gypsy Six) flown by Capt. E W. Percival which hung up the fastest lap (in the speed race) at 211.2 m.p.h, averaged 209 m p h

Port in Storm

Attempt to By to Lithuania ends in Ireland

First transatlantic flyer to get away this year was Felix Waitkus, a lieutenant in the Air Corps reserve. Sept 21, at dawn he lifted his Lockheed Vega neatly from the runway at Floyd Bennett Field bound for Lithuania That afternoon he was sighted passing over Placentia Bay, Newfoundland From there on he ran into continuous fog, clouds and rain Several times he had to change altitude to shed accumulations of ice. As he approached the Irish coast only 170 gal of his original 700 gal of fuel remained He milled on through unfavorable weather seeking Dublin by radio compass course. Over Ballinrobe in West Ireland he decided on an emergency landing in a hilly field. The slope threw one wing down to plough through the turf. The landing gear wiped off. The fuselage was damaged Thirteen hundred miles away a crowd of 10,000 went home in disappointment from the airport at Kaunas, Lithuania.

OVERSEA PRACTICE
in a landplane over land. A Hawker Nimrod single-seat naval fighter in catapulting practice at the R A F. school at Leuchars, Scotland

Transport Trends

T.W.A. starts upper air experiments. American orders Douglas sleepers. Columbia inaugurates a belt line

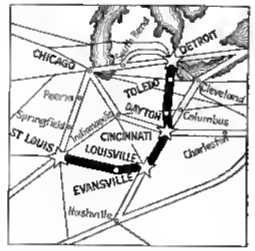
For some months T.W.A. has been quietly preparing its DC-1, "Number 300," for another round of trail blazing Early in September, D W Tomlinson, assistant to President Frye, broke the program into the news with a "sub stratosphere" non-stop flight from Kansas City to Newark. The ship's engines had been geared to supercharge to normal power at 16,000 ft Tomlinson and his two companions wore oxygen masks. The flight was made at an average altitude above 20,000 ft. At one time the plane reached 27,000. Time five hours four minutes—average speed 223 m p h

A few days later Tomlinson retraced the flight, this time at a much lower altitude, but with curtains drawn over the cockpit windows to make the trip a 1,200-mile all-blind demonstration.

Borrowed from the Air Corps, but not yet mounted, T.W.A. has two turbo superchargers. With them Tomlinson expects to reach 40,000 ft. for further cross-country tests. Cabin supercharging is under discussion.

C. R. Smith, president of American Airlines, announces that his company has placed an order for fifteen of the new Douglas DST transports with first deliveries expected in February. American plans to use them as 24-passenger day planes and 16-passenger sleepers.

United Airlines meanwhile have completed the replacement of all the Boeing 247 transports on its transcontinental services with the 247 D model. It expected to have its Pacific coastal line



similarly equipped by Oct 1 New San Francisco-Newark eastbound schedules are sixteen hours

In the Middle West a new organization, Columbia Airlines, has started an express and passenger service—Detroit, Toledo, Dayton, Cincinnati, Louisville, Evansville, East St. Louis. Intersecting almost every important airline in the region, the new route should do a great deal toward facilitating cross-line travel and shipments Its trimotored Stinsons are equipped with two-way radio, and carry stewardesses Its president is Edward G Bern

Traffic reports continue to mount. July figures—the latest available from the Bureau of Air Commerce—reached the record total of 34,040,925 passenger-miles. Fragmentary reports indicate that August figures would be substantially the same as those for July.

Adding just one more investigation to the transport picture, the House of Representatives took time during its last-minute rush before adjournment to appoint a committee to inquire into "whether adequate safeguards are provided and maintained for the security of air mail and passengers" It will also determine the extent to which air mail contractors reorganized to meet last year's air mail law Representative Mead sponsored the action

Sailor's Parade

Navy planes mass in review over San Diego.

Late in August Vice-Admiral Henry V. Butler led the flying strength of the fleet in the most impressive massed flight in its history Great crowds of visitors to the San Diego Fair, townsmen, thousands of school children thronged the water front Ninety ships

steamed in file from LaJolla to Point Firmin Patrol planes, scouts, fighters took the air Some 416 in all formed in five wide V formations to pass in review over the flagship Pennsylvania In contrast with the poor weather which marred the fleet's arrival in June, visibility was excellent

Federal Relief

Washington has so far approved 87,217,371 of individual airport projects.

SEVERAL months ago the Bureau of Air Commerce asked WPA administrators for a blanket $59,000,000 fund to be applied to airport construction and improvement throughout the country The relief authorities preferred to work through each state agency and to consider individual projects as they were submitted

As reported in the Schools, Services and Airports section during recent months the number of communities that have taken some steps toward getting federal assistance for their local landing fields is astounding But there's many a step between the first enthusiasts' luncheon and final Washington approval It often becomes difficult to determine just what the status may be of any particular project.

To clarify the situation we offer in the accompanying table a list of all communities which had received final Washington approval for aeronautical projects by Sept 10 It also lists the amounts involved in each case.

Engineering Only

Navy's aeronautical technicians relieved from duty notation.

NAVAL OFFICERS who desired to specialize in aeronautical engineering have long complained of the terms of fleet service they were required to discharge under Naval regulations. The last Congress took steps to relieve them of interruptions Under the new rule the design of aeronautical equipment is placed in the "engineering only" category and entitles officers who make it their sole duty to the same basis of promotion as line officers A committee of eight officers, headed by Rear Admiral King, has been appointed to receive and weigh applications for the new continuous duty.

Balloons

Poles capture Gordon Bennett Cup. Russians make endurance marks.

THIRTEEN BALLONS cast loose Sept 15 in Warsaw for the 27th annual Gordon Bennett Cup Race Westward they drifted across Europe By the nineteenth it seemed certain that Captain Zbigniew Burzynski, pilot of the Polish entrant Polonia had won first place with a flight

Approved Applications for Aviation Projects Submitted by State Administrators—Sept. 10, 1935

Birmingham, Ala	$ 35 946	Volusia County Fla	$ 1 950	Ann Arbor Mich	$ 22,150
Anniston Ala	71,794	Starke, Fla	5 670	Battle Creek, Mich	53,089
Clanton Ala	6 000	Duval County, Fla	5,631	Indian River, Mich	3,889
Dale County Ala	2461	Orlando, Fla	16 658	Jackson, Mich	103,600
Morgan County Ala	11,099	Osceola County Fla	11 182	Lansing, Mich	84 105
Dothan Ala	4 500	Polk County Fla	10 010	Marshall, Mich	12 251
Tuscaloosa, Ala	13 930	Polk County Fla	29 225	Grand Rapids Minn	40 174
Little Rock, Ark	6,892	Welaka, Fla	22 691	Baudette, Minn	1,152
Pulaski County Ark	15 122	Daytona Beach Fla	39 604	International Falls Minn	5,256
Little Rock, Ark	3,197	Jacksonville, Fla	92 125	Springfield, Minn	6,691
Los Angeles Cal	1,240 221	Jacksonville, Fla	5 622	St. Paul, Minn	599 731
Marysville, Cal	2,160	Keystone Heights Fla	3 033	Warroad Minn	3,059
San Francisco, Cal	9 575	Valparaiso Fla	10,146	Duluth, Minn	7.548
Denver, Col	3 090	Lavoeta Ga	6,640	Hibbing Minn	23 676
Pueblo Col	24,000	Winder Ga	17 080	Virginia Minn	25 153
Boulder Col	1 475	Moultrie Ga	3 424	Jackson Miss	14,049
New Haven Conn	40 862	Thomasville Ga	9 546	Red Bank Boro N J	13 875
Hartford Conn	231 120	Athens Ga	1-160	New York, N Y	1,625,502
Homestead Fla	1 249	Albany Ga	4 256	New York, N Y	203,660
Salem City Fla	2,511	Madison Ga	79,564	New York, N Y	34,650
Fort Pierce, Fla	3,289	Griffin Ga	34 792	Franklin Ohio	220
Sebastian Fla	13,196	Thomasville Ga	11 075	Mad River Ohio	29 902
Vero Raton Fla	19,329	Atlanta, Ga	526,590	Mad River Ohio	31,655
Delond, Fla	19,943	Cordele Ga	5,042	Montgomery County Ohio	100
Lake City Fla	20 911	Cordele Ga	5 629	Richfield, Ohio	164
Wauchula, Fla	2 000	Douglas Ga	2,620	Tuscarawas, Ohio	452
Tampa, Fla	46 690	Lavona, Ga	16,175	Wyandot Ohio	270
Folkston, Fla	1 522	Waycross Ga	20 128	Vernonia, Ore	4,617
Bronson Fla	8 020	Indianapolis Ind	1-250	Klamath Falls, Ore	4 700
Bradenton, Fla	2,200	Richmond Ind	208 178	Pittsburgh Pa	209
Okeechobee County Fla	10,252	Valparaiso, Ind	32 582	Charleston County S C	144
Holopaw Fla	3 609	Lake Wawasee Ind	13,488	Brookings, S D	2,040
Gainesville Fla	13 554	Columbus Ind	2 640	Theresa S D	67,999
Arcadia Fla	6,791	Michigan City Ind	80 010	Salt Lake City, Utah	104,582
Sebring Fla	6 744	Fort Wayne Ind	50 304	Price Utah	3 902
Avon Park Fla	21,913	Ft Benjamin Harrison Ind	62,950	Burlington, Vt	12 928
Davis Island Fla	105 343	Angola Ind	17 060	Bristol Vt	4,134
Titusville Fla	14 358	Culver Ind	53 005	Saint Johnsbury, Vt	3,406
Broward County Fla	14 467	Indianapolis Ind	98 346	Yorktown Va	2,950
Sarasota Fla	3 414	Marengo, Ind	4 442	Seattle, Wash	4 033
Marion County Fla	69 557	Muncie Ind	5 988	Ellensburg, Wash	1,280
Orange County Fla	57 619	Sullivan Ind	44 136	Cle Elum Wash	5 631
Palm Beach County Fla	108 071	Washington Ind	717	Mt Pleasant W Va	11,184
Santa Rosa County Fla	10 760	Wyanaac Ind	1 264	Bolling Field, D C	209 636
Venice Fla	7 433	Donaldsonville, La	7 764		
Seminole County Fla	11 580	Waterproof, La	1,115		
St Johns County Fla	10 429	Dowagiac Mich	2 051		
St Lucie County Fla	15 086	Lansing, Mich	6 928	National Total	$7 217,371

of 1,054 miles to Stalingrad province in Soviet Russia. Another Polish balloon the Warszawa, took second place with 993 miles. The U. S. Navy entrant, piloted by Lts. Raymond Tyler and Howard P. Orville were forced down near Elsk 520 miles from the start.

On Sept. 21 Soviet authorities reported a flight of 1,328 miles by B. Romanoff and A. Badykin from Moscow to the Kum Dessert, a new record for 2,200 cubic meter balloons. The next day they claimed a second record flight. I. I. Zyhoff and A. M. Tropin had remained in the air 91 hours and 31 minutes to drift 1,336 miles to a point in Kazakstan. The best F.A.I. duration record for any category is 87 hours.

Pursuits Compete

Air Corps starts tests on Curtiss-Wright and Seversky models.

PRICES bid by manufacturers of three new pursuit planes, said to be faster than any other ships in the Air Corps, have been disclosed by officials at Wright Field where two of the models await evaluation tests.

The third model, the Northrop pursuit plane (lost with Lieut. Skaer last summer, just before it was to have been flown on a second trip to Wright Field) eliminated itself from the present competition with its unexplained disappearance.

Yet the Northrop bid was lowest—$25,850 on an order of 25.

Seversky Aircraft offers its pursuit for $27,000 on an order of 25, Curtiss Aeroplane and Motor of Buffalo asks $33,413.

Bids were submitted in increments of five between 25 and 200. Comparative bids were: for 50, Curtiss $24,302 and Seversky $24,200; for 100, Curtiss $18,720 and Seversky $17,950; for 150, Curtiss $17,050 and Seversky $13,850; and for 200, Curtiss $16,258 and Seversky $12,600. Northrop bid $13,490 on a possible order of 200.

Both remaining ships are all-metal, one-place monoplanes said to be capable of more than 275 m.p.h. Seversky, powered with an 850 h.p. Wright Cyclone, claims 300 miles. The Curtiss also is equipped with a Wright Cyclone, Northrop had mounted a 14-cylinder two-row radial air-cooled motor.

The Curtiss and Seversky models are to be evaluated by a board comprising Lt. Col. M. F. Harmon, Barksdale Field, La.; Lt. Col. Ralph Royce, Selfridge Field, Mich., Lt. Cols. A. H. Gilkeson and H. H. George, Langley Field, Va.; Majors C. L. Chennault, Maxwell Field, Ala., and P. P. Hill, Wright Field, chief of the flying branch, and Capt. R. G. Hoyt, Washington, D. C.

Work in Progress

Vidal calls for bids on feeder transport. Plane production up fourteen per cent in the first six months of 1935.

EARLY last April, Eugene Vidal and other Bureau of Air Commerce officials called airline representatives to a discussion of ways in which the Bureau might best help transport progress. Most striking suggestion made was that the Bureau might help develop a small transport for feeder line use. For months the Development section worked on specifications. Last month the Bureau asked for bids.

Highlights of the seven-page announcement — Minimum high speed, 175 m.p.h. Maximum acceptable landing speed, 65 m.p.h. There must be at least two engines. Ceiling on one of them must be 6,000 ft. The cruising range must be 1,000 miles with two pilots and 400 lb. of cargo. The plane must accommodate five passengers. It must mount automatic pilot, de icers, controllable propeller, radio compass, two way radio. The cabin must be sound proofed. Alternate designs must be offered to permit mounting two or three wheel landing gear. Bids and evidence of the bidders' financial, engineering, and production resources are desired by July 1, 1936.

In the same Air Commerce Bulletin (September 15) that contained the invitation specifications, was published a long report on the Vee belt drive experiments conducted under Bureau direction at the Casey Jones School of Aeronautics at Newark. (See page 35 for report extracts.)

Statistics are finally available on aircraft production in the United States for the first six months of 1935. Total for the period was 851, a 14 per cent increase over the figure for the same period last year. Of the 851, domestic civil consumption took 517, export 161, military deliveries 173.

Some 81 companies and individuals produced aircraft during the period. But thirteen companies accounted for 82 per cent of the total production.

Waco Aircraft has announced the receipt of an order for fourteen planes from the Brazilian government for use in an airmail service along the Atlantic Coast and the Amazon River. The $160,000 order brought the total of Wacos sold to Brazil within the last few years to nearly 200. Late in August reports indicated Waco was operating at full capacity with some 50 orders on hand.

Talyor Aircraft of Bradford, Pa., reports two dozen sales in July.

Lockheed has delivered the first of the five Electras it is building on order from Eastern Airlines.

Calendar

Sept. 23-Nov. 1—N.A.A. 'Air Progress' campaign to publicize aeronautical achievement.

Oct. 14-21—Air Navigation Week, a part of the above program.

Financial

Fairchild, Sperry, and Irving report profits. Six months losses for North American and Waco.

• NORTH AMERICAN AVIATION report for the half year ending June 30.

Net loss after depreciation and including a $33,265 profit from security sales	$66,815

North American will receive approximately $70,000 in adjustment of its airmail compensation to June 30. No part of this amount is included in above statement. Last year the company reported a net profit for the corresponding period of $743,872 including $1,199,942 profit from the sale of securities.

• FAIRCHILD AVIATION CORPORATION report for the half year ending June 30.

Net profit before federal taxes	$87,184
Per Share	$.13

Sales for the period have been approximately a half million, slightly less than for the first half of 1934. But unfilled orders on hand June 30 amounted to $1,302,634 compared with $535,854 a year previously.

• IRVING AIR CHUTE statement for the half year ending June 30 reported earnings of $170,276, substantially higher than for the entire year of 1934. Surplus had increased from $806,284 Dec. 31 to $931,972 June 30.

• SPERRY CORPORATION report for the half year ending June 30.

Consol. net income including a profit of $87,184 on security sales	$803,752

• WACO AIRCRAFT report for the half year ending June 30.

Sales	$250,836
Net Loss	$7,740

• A typographical error in this department last month caused us to report a loss for Wright Aeronautical and a profit for Curtiss-Wright. Actually Wright Aeronautical earned a profit of $60,608 during the first six months of 1935. Curtiss-Wright suffered a loss of $260,228.

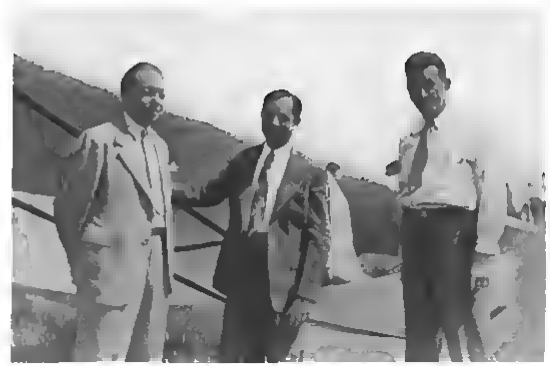
Schools, Services, and Airports

● ALABAMA—A crowd of 10,000 witnessed an air show, late in August put on by the BIRMINGHAM Aero Club. Birmingham flying enthusiasts are already looking forward to another airshow, the City's Annual Air Meet, which will take place Oct. 5 and 6. Steadham Acker entertained the Pilot's Sunday School Class of Birmingham's East Lake Methodist Church of which he is teacher, at the Municipal Airport late in August. A new type of paving, a mixture of cotton and asphalt, is being installed experimentally at Reilly Field, ANNISTON.

● ARIZONA—PHOENIX is beautifying the grounds about Sky Harbor. The areas around the hangars are being landscaped, and the adjoining streets improved.

● ARKANSAS—Day air mail service at LITTLE ROCK cancelled Jan. 1, when the Municipal Airport was declared to be too small for safe landings of the big Douglas transport planes of the American Airlines, has now been resumed following improvements to the field. Projects calling for additional expenditures of $150,000 to carry the improvements further are being studied.

● CALIFORNIA—Earl W. Woodley and J. D. McCutcheon have bought a new Taylor Cub and have taken over the management of the COMPTON airport. They offer flying instruction, passenger and charter flights. The annual report of the LONG BEACH municipal airport shows that a total of more than 25,000 flights were made from the field during the year ending June 30, 2,596 passengers arrived at or departed from the port, and 1,275 out-of-town planes landed there. Grading on MONTEREY'S 38-acre airport is almost completed. Surfacing of runways will begin soon. The owners and operators of the Carpinteria Airport, Mr. and Mrs. Daniel Henry Wallace, with Catherine Ferris, have filed articles of incorporation for the SANTA BARBARA Aircraft Sales Company. They also plan to open an aviation school. The SAN DIEGO Junior College has added a course in aeronautics to its curriculum. It will be given partly at the college, and partly at the Ryan School of Aeronautics. Tuition is $60 in addition to the regular college fees.



Loomis

SOARERS AGREE

That WPA funds for the improvement of the Elmira soaring sites and for barracks, and shops there will advance their cause strikingly within the next year. Left to right: Maxsel Holderman, Ralph Hannaly, president of the Soaring Society of America; Earl Smithee, Society director; and manager of this year's Elmira Meet.

The Pathfinder Flying Services Ltd. at the STOCKTON airport has added a third Fairchild cabin monoplane to its fleet. The RIVERSIDE Aero Club which originally devoted their time to model and glider building, has now purchased a Curtiss Junior and gone in for power flying. Roman C. Warren, airport manager, is advisor of the group. The ALHAMBRA Chamber of Commerce put on an air show on Labor Day.

● COLORADO—The University of Colorado Flying Club has opened a campaign to enlist 500 boys from DENVER and the surrounding territory into an organization to be known as Air Scouts. The Club departs from the usual pattern of college flying societies in being open to any air-minded person in the community. Recently it took an active part in insuring the passing of the bond issue to bring the Air Corps Technical School to Denver from Rantoul, Ill. Its present membership is 40. Denver plans a wide program of displays and flying exhibitions for the week of Oct. 13-20 in connection with the N.A.A.'s national program of aerial progress publicity.

● CONNECTICUT—The airport at PHELPS CROSSING, completed last year, and since that time practically unused, was formally opened by an air show Labor Day week-end. Walter Laudenslager, manager of Stephenson Field, EAST BRISTOL, reports a marked pick-up in business there. Five planes are now quartered at the field. Capt. Frederick P. Sansom of Brainard Field has opened a mechanics course and a ground school in HARTFORD. The members of the teaching staff are: Lieut. A. Lewis MacClain, motor instructor; T. A. Lowe, welding; William H. Thompson ground school, Clarence B. Rand, mechanics courses. Lieut. Ernest L. Markham of the MERIDEN airport was recently appointed chairman of the local committee of the National Aeronautical Association. The first Connecticut WPA job to be approved was the NEW HAVEN Municipal Airport project.

● DISTRICT OF COLUMBIA—The National Capitol Park and Planning Commission has come out once more in favor of GRAVELLY POINT as a suitable site for a municipal airport in the District. Nothing can be done about the

airport problem in the capitol, however, until Congress reconvenes next January.

● FLORIDA—The Junior Chamber of Commerce sponsored an air show at the LAKELAND municipal airport on Labor Day. . . . The Bureau of Air Commerce has definitely decided to install radio approach equipment at JACKSONVILLE's municipal airport. The northwest-southeast runway will be used.

● GEORGIA—The city of SAVANNAH, with WPA assistance, plans to erect a hangar and machine shop at Savannah Airport. It hopes, also, to secure funds to construct four runways. . . . Edward Horton has organized a flying school in CORDELE. By the middle of September eleven students had joined and plans were under discussion for a ground school. Instruction is being given in an Aeronca. . . . H. A. Strickland, president of Air Service, Inc. new operating company in ATLANTA has announced the acquisition of the Bellanca sales and service rights for the state.

● IDAHO—The Zimmerly brothers of the LEWISTON airport flew their planes to the COTTONWOOD, DAYTON and WALLA WALLA fairs recently on a barnstorming venture. They have meanwhile been receiving reservations for charter flights by hunting parties to the SELWAY game preserve. . . . Ten thousand spectators turned out for an air carnival in POCATELLO, Sept. 16. The meet was marred by the death of a girl parachute jumper during the last minutes of the program.

● ILLINOIS—The HARRISBURG City Council has been petitioned to renew the lease on the municipal airport. If the council grants the petition, improvements and maintenance of the field will involve an expenditure of $150,000 under the Federal Recovery program. . . . Dr. L. K. Wyatt has been made PEORIA's local director of the National Aeronautical Association's publicity campaign. . . . The QUAD-CITY Airmen's Association took in three new members at their mid-August meeting: George Christison and Robert Bimson of MOLINE, and Avery McMillan of DAVENPORT. . . . The Illinois National Guard will use the KENOSHA airport as a base of operations for their tactical maneuvers during their 30-day training period this fall. . . . The Curtiss-Stemberg field, EAST ST. LOUIS has been selected by Columbia Airlines (see page 48 for complete system map) as its western terminal. . . . Sept. 15, twelve women flyers from Chicago area flew in a treasure hunt from the Curtiss-Reynolds airport, CHICAGO. Alice Adamec was the winner.

● INDIANA—William Clark and Robert Peters, pilots, sponsored an air show and circus at KNOX, Sept. 1. . . . The program of the Indiana and Michigan Air Fair held at the MISHAWAKA Airport Sept. 7 and 8 included races, a pageant of progress, stunting, and skywriting. . . . The GOSHEN City Council, in its new budget eliminated funds for continuing its present airport. Since it is on rented ground and is kept up at a considerable cost, the motion was passed that the city take steps to purchase its own airport land. . . . Major Charles E. Cox, superintendent of the INDIANAPOLIS municipal airport, has been appointed regional supervisor of airport projects in seven Mid-western states by the Bureau of Air Commerce.

● IOWA—SHELDON's airminded citizens saw an air show, late in August, put on by Robert Starrett, manager of the Sheldon airport. Several out-of-town pilots competed in the contests. . . . Morningside College, SIOUX CITY, has announced a new course leading to the degree of Bachelor of Science in Aeronautical Engineering. Shop and field work will be furnished in conjunction with Hanford Airlines.

● KANSAS—The Beech-Swope Flying Service, Inc., of the Beech Airport, WICHITA, recently purchased an Aeronca and a Security Airster to be used in flight instruction. . . . The Braniff Airways has installed a new two-way short wave radio set at Wichita municipal airport. . . . The Bureau of Air Commerce has appointed Fred H. Grieme of Wichita as regional supervisor for the airport construction and improvement to be undertaken with WPA funds. His territory includes North and South Dakota, Minnesota, Iowa, Nebraska and Kansas. . . . TOPEKA, which now leases its airport, is considering purchasing the site so it can obtain Federal aid for improvements. The estimated cost of building hangars, runways, and equipping the field with lights is $90,000.

● KENTUCKY—The Rugby University School of LOUISVILLE has formed an aviation club. Kenneth C. Bartman is its president. . . . The PADUCAH airport has put on a campaign to increase the number of local pilots and has already enrolled a number of new flying students. . . . Hi Richardson Field, was the base of operations for the Jones Air Squadron during their recent short visit to DANVILLE. They took up passengers for short hops, and offered flying instruction. . . . The LEXINGTON Air Taxi Service publicised the opening of its operations with a small air show Sept. 1. E. A. Welch is president of the new company.

● MAINE—Additional business will be brought to the PORTLAND city airport at Stroudwater by the Northeast Airways, Inc., which will make its headquarters there. The firm, headed by Edward C. Bessey of Portland, will offer flying instruction hops, and charter service. . . . Portland is laying tentative plans for constructing another hangar and a third runway, and installing flood lights. The estimated cost of the project, which will be submitted to WPA officials for approval, is $100,000. . . . Another city planning to improve its airport with government aid is BAR HARBOR, which has developed a thriving summer airplane traffic. . . . The Maine Aero Club, composed of all licensed pilots in the state as well as airport officials and managers, recently met in AUGUSTA to hear speeches by Ruth Nichols, Clarence Chamberlain, Hugh Herndon, and others. . . . The Aero Club has been stimulating interest in flying by sponsoring a state-wide good will tour by Ruth Nichols and Clarence Chamberlain.

● MARYLAND—The completion of BALTIMORE's municipal airport at DUNDALK will require two years work and an expenditure of $1,198,968. Logan Field will continue to be used as the city's airport until the new field is finished. . . . HAGERSTOWN plans to construct a hangar with WPA funds at its airport. . . . CUMBERLAND's City Council has adopted recommendations made by the city airport committee. These include the construction of a public hangar, installation of fire apparatus and a radio at the field, and adoption of traffic and safe flying rules.

● MASSACHUSETTS—The BROCKTON Aeronautical Association held its first meeting late in August, and elected as officers: Fred Elliot, president; Stephen Bigney, vice-president, Eugene Dunbar, secretary. The aims of the organization are to stimulate interest in aviation and to encourage interest in the construction of a municipal airport. . . . The newly constructed race-track at AGAWAM PARK which will open formally on Oct. 1 has made provision for visiting pilots. . . . OYSTER HARBORS saw its third annual seaplane meet late in August. . . . BOSTON citizens are inaugurating a campaign for naming the EAST BOSTON Airport after Capt. Albert F. Hegenberger, formerly of SOUTH BOSTON. . . . The New England Aircraft School at the East Boston Airport which holds government certificates as an approved mechanics school and as an approved repair station, is offering a two-year aircraft engineering course to high school graduates.

● MICHIGAN—The Aeronautical Activities Association of Michigan sponsored a Michigan Air Circus held Sept. 14 and 15 at the WAYNE COUNTY airport. The program included acrobatics, races and a world's record amphibian speed dash by Maj. de Seversky. . . . FLINT aviation enthusiasts saw an ex-

hibition of stunting put on by two local transport pilots, Gordon Helm and C. B White. . . . The FLINT Pilot's Club held an amateur air show Sept 22 . . . BIG RAPIDS' proposed airport site north of the city has been inspected and approved by state officials. . . . In order to accommodate the increasing traffic at the DETROIT city airport, application for more than $200,000 of WPA funds has been made for necessary improvements. Weather reporting teletype and broadcasting service will be installed at the Wayne County airport by Oct. 1

● MINNESOTA—The MARSHALL City Council recently approved an appropriation to build a hangar at the airport. . . . The city officials of MANKATO have leased the airport there to prevent its sale for other purposes. . . . The MINNEAPOLIS Arrowhead Association has asked Postmaster General Farley to consider DULUTH as a possible center for a secondary air mail route

● MISSISSIPPI—Key Field, Meridian, will have extensive improvements as part of a WPA project It will be graded, properly drained, and have its north-south runway extended 600 ft

● MISSOURI—Among new enrollments at the Robertson Aviation School, LAMBERT-ST. LOUIS airport, is Jesus Carranza, son of former President Carranza of Mexico . . . Acting on complaints from SPRINGFIELD citizens, Byron Crutcher, chairman of the park board's airport committee, recently prohibited all flying from the airport before 6 A M . . . The ST LOUIS Municipal Airport Association is sponsoring the marking of oil stations throughout Missouri to facilitate their identification by airplane pilots. Several oil companies are already cooperating in the campaign . . . Between 30 and 40 planes took part in the Association's Third Annual Lambert Field—Bagnell Dam air cruise Sept. 14

● MONTANA—The Jellison Flying Service of SHELBY has added a 7-passenger Fokker cabin monoplane to its equipment available for charter service on cross-country flights . . . After improvements to its airport have been completed, PLENTYWOOD hopes to be designated as a port of entry for international air traffic. . . . The BOZEMAN city tax levy for 1936 has been increased 1 mill to provide for the construction of an airport

● NEBRASKA—Nebraska's new aviation law, creating a state aeronautical commission to have charge of aviation regulation in the state went into effect late in August. Clinton J. Campbell of LINCOLN was elected chairman . . . A. L. Rushton is the new chairman of the OMAHA Chamber of Commerce's aviation committee. . . . Administration of the Omaha airport has been transferred from the Streets to the Park department

● NEVADA—The WASHOE COUNTY commissioners have agreed to purchase the land east and north of Hubbard Airport and to enlarge the landing field, providing federal money can be obtained with which to construct a 4,000 ft. runway.

● NEW HAMPSHIRE—BERLIN is seeking WPA funds for improving the condition of the municipal airport. . . . NASHUA dedicated its new city airport and hangar with a big celebration Sept. 8 . . . The New Hampshire Aero Club marked its September meeting by a banquet served in the newly completed hangar.

● NEW JERSEY—The Tri-county Aeronautical Club of PLAINFIELD has filed articles of incorporation . . . The recently formed ELIZABETH Flying Club was entertained at a party at the WESTFIELD airport by Kenneth Woundy to celebrate his first solo flight He is the first club member to solo . . . A large crowd attended the last events of the three-day meet of the Associated Gliding Clubs of New Jersey at LIBERTY CORNERS, Sept 2. . . MORRISTOWN aldermen recently approved a project for the completion of the Morristown airport. The work will be done with the aid of a $125,000 WPA grant. RED BANK has already received a WPA grant of $13,875 for improvements to its airport . . . The ATLANTIC CITY airport has been leased for $150 a month plus 5 per cent of the gross income to the East Coast Airways, Inc . . . NEWARK airport officials are still rejoicing at the refusal of the Post office Department to transfer the air-mail terminus for the New York metropolitan area from Newark to Floyd Bennett Field. They are now planning to expand the airport with a WPA grant of $3,400,000 approved late in September by Washington authorities.

● NEW YORK—Frederick Von Newman, secretary-treasurer of the YONKERS Aviation Club, and president of the newly formed Yonkers Aviation Airways Inc, a subsidiary of the flying club, has announced plans for a passenger service between Yonkers and the Middle West. . . . The Yonkers Aviation Club has decided to erect a floating seaplane base with hangar and workshop in the Hudson River. This plan was devised after the city refused permission to lease Yonkers River front property at Sunset Park for the club's base. . . . The Islip Airport (BAYSHORE) will soon start the construction of a new brick hangar to replace the one destroyed by fire two years ago . . . Activities of the ELMIRA Gliding Club are at a standstill following the recent announcement that the Caton Avenue Airport where the club conducts its groundwork has been sold. . . . BUFFALO is seeking a WPA grant of $550,000 for improvements to its airport. . . . A two-day air meet at Buffalo on Sept. 7 and 8 drew a large number of out-of-town pilots as contestants, as well as thousands of spectators. . . . Members of the Montreal Light Airplane Club made a good-will flight to ROOSEVELT FIELD early in September, returning the visit of Roosevelt flyers to Montreal earlier in the summer. . . . FORT PLAIN plans to dedicate its airport Sept. 28. . . . WATERTOWN dedicated its new field Aug 28,

A LITTER OF CUBS

and one Fairchild lined up for the day's flying and sales effort at Central Jersey Airport (See page 38)

naming it the Scherer Laverty field in memory of two local flyers . . KINGSTON and CLAYTON have just completed preliminary surveys for new airports . . . . Since no WPA funds are available for its proposed airport, CANTON has given up plans for the present . . . Plans for a Westchester County airport and seaplane base to be constructed at CAOTON has been submitted to the WPA for approval.

● NORTH CAROLINA—Among the cities and towns who have already or will soon present airport plans to the WPA for approval are: HICKORY, WINSTON-SALEM, WASHINGTON, NEW BERN, CHARLOTTE, GREENSBORO, DURHAM, . . . SALISBURY reports increased activity at its airport due to the recent improvements made in hangars and runways

● OHIO—National Air Races of CLEVELAND, Inc. the organization which has sponsored the races for the last five years, has completed negotiations with the National Aeronautical Association to hold the races in Cleveland for the next five years . . The Moore Flying Service, and the DAYTON JUNIOR Association of Commerce sponsored an air meet at Vandalia late in August. . . . The SPAINGFIELD Chamber of Commerce is making efforts to secure improvement of the city's airport. . The AKRON airport commission is still attempting to iron out the dispute over possession and operation of the air service hangar at the airport. Meanwhile, tentative plans are being made to dispose of the airport to the government as a commercial field and as a training school for army or navy flyers. Federal authorities are repocted "interested"

● OKLAHOMA—The WPA allotment board has approved a $25,000 expenditure for the improvement of MUSKOGEE's airport. . . Moss Patterson, president of the Oklahoma Transportation Co, has been appointed regional director of a federal airport construction program.

● OREGON—The Sportsman Pilots Club had its final fling of the season with a big show at MARSHFIELD . . VERONONIA dedicated its new municipal airport with an air show . . KLAMATH FALLS witnessed its first air races early in September. The event was sponsored by the Klamath Aero Club . . . The Aero Club of PORTLAND has moved to new quarters Membership is increasing rapidly . . . EUGENE'S new airport was dedicated Sept 15

● PENNSYLVANIA—The Rising Sun Aircraft School, Inc of PHILADELPHIA has purchased a Boeing DH 4M-I plane which they will utilize in their course of instruction. The plane originally built in 1922, will be completely reconditioned by students of the school. . . . Jesse Jones, superintendent of the LANCASTER municipal airport recently gave a demonstration of orchard spraying by plane. . . DUBOIS dedicated its new airport in mid-August with an air show. . . The christening, by Laura Ingalls, of the "City of Lancaster," TWA airliner, was a feature of the dedication of LANCASTER'S $300,000 airport. . . . OIL CITY saw its second annual air show last month. It was sponsored by the Oil City Aero Club . . The JOHNSTOWN Aero Club has elected the following officers: John D Reese, president, Charles H Temple, vice-president; Wilham Rhoades, secretary; Robert Hart, flying director. The Flight Division of the club, a group of twenty, is being organized to purchase a plane on the club plan. . . . An air meet, sponsored by the Telegraph newspapers was held at the HARRISBURG airport Sept. 15.

● RHODE ISLAND—The cement runways at the State Airport at HILLSGROVE are now completed and field lights are being installed.

● SOUTH CAROLINA—Duke Fernald's American Aces recently put on air shows at ANDERSON, under the auspices of the American Legion, and at GREENWOOD under the auspices of the Greenwood Mill Baseball Club.

● TENNESSEE—NASHVILLE plans to add 22 acres to the proposed city airport site . . WASHINGTON COUNTY Court voted Sept. 14 (19 to 18), against the County's joining some five other communities in the purchase of a site near HOLSTON INSTITUTE for an Upper East Tennessee airport.

● TEXAS—Operators at Love Field, DALLAS are seeking cooperation of the city aviation committee In an effort to make further improvements at the municipal airport, and possibly to obtain a terminal building . . Governor Allred has appointed an "unofficial airport development advisory committee" to make an effort to secure improvement of airports. One of the appointees is Elliott Roosevelt, son of the President.

● UTAH—J. E Garn, state road commission engineer at RICHFIELD has been appointed regional supervisor of WPA airport projects.

● VERMONT — RUTLAND'a recently improved municipal airport was the scene of an airshow late in August. . . . BAISTOL is to have an airport constructed with WPA funds

● VIRGINIA—One of the three hangars owned by the N.A.C.A Aero club and located on the club's flying field on Fox Hill Road, NEWPORT NEWS was destroyed by fire. Several planes were damaged . . DANVILLE had an air show, late in August, sponsored by the American Legion . . LYNCHBURG held an aerial rodeo at PRESTON GLENN airport on Labor Day week-end . . . ROANOKE'S municipal airport will have an asphalt apron provided with service pits for planes as part of a FERA project . . . Work on the new BLACKSTONE airport has been resumed under the supervision of the State Airport Division

● WASHINGTON — Felts Field, SPOKANE, recently held an "open house-get-acquainted" day Exhibitions and stunt flying were featured. . . . SEATTLE also saw an air show at Boeing Field early in September

● WEST VIRGINIA — CHARLESTON plans the purchase of land at its airport in order to obtain a WPA grant with which to make necessary improvements . . Norman Rintoul and George DeGrange recently put on an air show at Shepherd Field, MARTINSBURG . . . BLUEFIELD also had an air show in mid-September . . . State Senator J. P Beacom of Huntington has been appointed chairman of the West Virginia committee of the National Aeronautical Association

● WISCONSIN—Due to increases in its business, Midwest Airways, Inc MILWAUKEE, has leased the Number 2 hangar at the Milwaukee County Airport. They plan to devote considerable time and effort to the development of their school facilities this year. Motor maintenance, welding, line inspection, fabric work and refinishing will be offered. Dwight S. Mills will give the ground and mechanic school instruction for the third year.

● WYOMING—The County Board of Commissioners recently closed the CHEYENNE municipal airport road for a distance of half a mile. The road area, together with an adjoining tract of land already owned by the city will be used in extending the airport . . CASPER has applied for $33,000 WPA funds for improving its airport.

Calendar

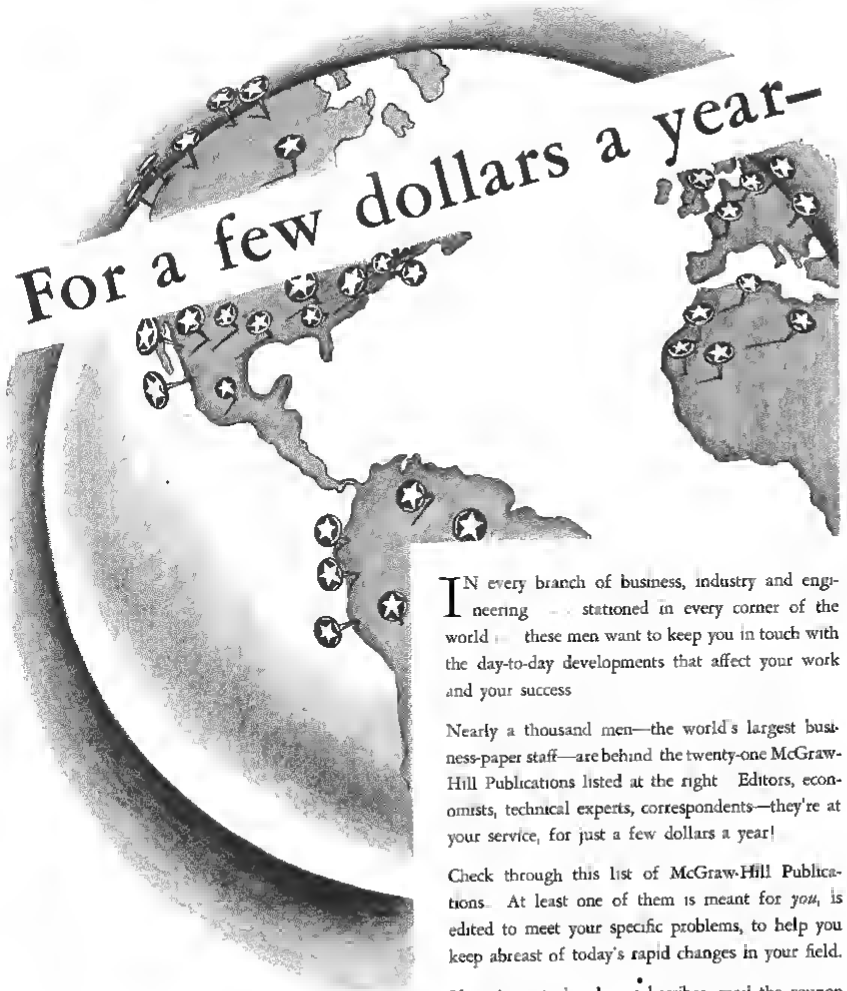
Oct. 2—Start of Kansas Air Tour Wichita, Kan

Oct 4-5—Regional Airport Conference, Birmingham Ala

Oct 5-6—Fifth National Air Carnival Municipal Airport, Birmingham, Ala

Oct. 6—Air show, Municipal Airport, Wichita, Kan.

Nov 10-11—Women's National Air Races, Municipal Airport, Long Beach Cal



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Aviation People

• The Society of Automotive Engineers, at its National Production Meeting in Cleveland, Sept 19, announced among nominations for officers in the forthcoming election those of MAC SHORT for vice-president representing aircraft engineering, and of OPIE CHENOWETH for vice-president representing aircraft-engine engineering. Mr. Short is vice-president and chief engineer of Stearman Aircraft Company, Mr Chenoweth a research engineer with the Army Air Corps stationed at Wright Field.

Mac Short

• For bravery and efficiency during the loss at sea of the Macon on Feb. 12, 1935, SECRETARY SWANSON last month commended LIEUT COMMANDER HERBERT V. WILEY, LIEUT JOHN D. REPPY, and FIRST CLASS RADIO MAN ERNEST E. DAILEY (the latter one of the two casualties). Similarly ADMIRAL HENRY V. BUTLER of the Battle Force extolled the heroism of LIEUT FREDERICK N. KIVETTE, LIEUT EARL VAN SWEARINGEN and CHIEF BOATSWAIN'S MATE ROBERT J. DAVIS. Entry of exemplary conduct was also made in the Fitness Reports of eight officers and 33 enlisted members of the crew.

Lieut.-Comdr Herbert V. Wiley

• The Spanish Government has awarded the Great Cross of Naval Merit to JUAN DE LA CIERVA, inventor of the autogiro. It has also named RAMON FRANCO as air attache to its Washington Embassy. In 1926 Franco became the first person to fly from Spain to South America. In 1929 he was forced down near the Azores in an attempt to fly from Spain to the United States. He has long been associated with the republican movement in his country.

Juan de la Cierva

• MRS MAE HAIZLIP is the holder of the women's speed record of 255.5 m.p.h. Last month she joined AMELIA EARHART, PHOEBE OMLIE, CAMILLE STEIN, and HELEN RITCHIE in becoming actively engaged in air transport activities. Mrs Haizlip has been appointed manager of passenger traffic for the St. Louis, Louisville, Evansville, and Cincinnati division of Columbia Air Lines.

Mrs. Mae Haizlip

• "For his courageous foresight in laying the foundation of military aviation" The Institute of the Aeronautical Sciences has made MAJ.-GEN. BENJAMIN B. FOULOIS an honorary member. This is the second time the Institute has conferred such an award, the first having been to Dr. S. A. Reed. Major Foulois will retire from the Air Corps on Dec. 1.

Maj.-Gen. Benjamin B. Foulois

Charles Dickinson

• After spending three years in China in organizing the Central Aviation School at Shienchiao, COL. JOHN H. JOUETT has returned to this country to join the aviation department of Colonial Beacon Oil Co., Inc. Colonel Jouett served in the United States Army from 1910 to 1930, saw action in France, later founded the U.S. Army Balloon and Airship School at Langley Field. He was chief of personnel in the Office of the Chief of Air Corps and played a prominent part in the preparation of the Air Corps Act of 1926. In 1930 he became technical advisor to the Stanavo Specifications Board and manager of the aviation department of the Standard Oil Company at New Orleans.

• JOSHUA CRANE, JR., widely known New England pilot and agent for Waco Distributors, Inc., lost his life on Aug. 28 when his plane went into a spin at a low altitude over the Rhode Island State Airport. He and ARTHUR E. HOWE, JR., of Philadelphia, who was critically injured, were enroute to the National Air Races at Cleveland. Mr. Crane had been active in New England flying circles for many years and had made many outstanding "mercy" flights. His log showed more than 3,000 hours, some 25,000 passengers carried without mishap.

• Summerill Tubing Company of Bridgeport, Pa., has re-elected E. L. PARKER as president. Mr. Parker's former assistant, J. P. BOOBE, was made vice-president, succeeding N. H. WOLF who continues his position as general manager. The offices of treasurer and secretary, hereto held by Mr. Parker and Mr. Wolf respectively, are merged under GEORGE P. KRAEMER. New assistant to the president is H. M. BRIGHTMAN, who will devote himself to research and engineering problems at Pittsburgh.

• East-bound travellers during September were RAYCROFT WALSH, vice-president, and FRANK W. CALDWELL, chief engineer, of Hamilton Standard Propeller Company. Their itinerary calls for a three months' business trip through Europe.

■ In 1910, when aviation was an adventure reserved for the young, CHARLES DICKINSON made his first flight as a passenger at the age of 52. An aviation enthusiast despite his years, he became a licensed pilot at 63, making his

first solo flight in 1921. Three years later he piloted a plane from Chicago to New York. With Will Rogers he has been called America's foremost air passenger. One of his hobbies was to be the first passenger to purchase a ticket over newly opened air lines. Mr. Dickinson turned to the building of aircraft in 1920, supplied the money for the purchase of Ashburn Field, Chicago's first airport. For twenty years he occupied the presidential chair of the Aero Club of Illinois. His death on Sept. 2, at the age of 77, deprives aviation of one of its most gallant pioneers.

▪ John Hopkins University has announced the appointment of LIEUT.-COMDR. P. V. H. WEEMS to the staff of its evening technical school, as instructor in aerial navigation. From 1924 to 1927 Weems was instructor in navigation at the Naval Academy, in 1931 and 1932 navigation research officer for the Navy Department. His books "Air Navigation" (which was awarded the gold medal of the Aero Club of France), "Star Altitude Curves," "Air Almanac," "Line of Position," and his aircraft sextant and second-setting watch are well known to all students of celestial navigation.

▪ HERBERT F. POWELL has been named managing editor of *Flying Aces*. For several years he served on the staff of AVIATION as news editor.

Side Slips

By Robert R. Osborn

JUDGED from a purely aeronautical standpoint this year's National Air Races would certainly be classed as mediocre, but, as official recorder of this unusual in this airplane business, we are glad to announce that a new "farthest north" was established in

aeronautical writing at Cleveland. Mr. E.P.W. picked up the following from a news ticker in New York, and, after all of the data has been officially homologated by the F.A.I., this bit of writing will undoubtedly be awarded the Side Slips Trophy for Lurid Aviation Reporting:

"Municipal Airport, Cleveland, By INS: The lure of a mad round of thrills unequalled in aerial annals today drew 50,000 rabid, wide-eyed followers of the whirling propeller and the screaming motor into the rambling stands of the largest airport in the world. . . . Looming as the bright spot of this double dose of daredevil didos was the Amelia Earhart Trophy Race for Women, slated for late afternoon. Members of the fair sex, constrained from participation in last year's races, are champing to get out there and show those men. Extensive happenings are forecast. The event will be contested over a closed 15-mile course, five laps to the 75 mile race. Practically without exception the finest powder puff pilots of the country will put their steel air rockets through qualifying trials before the starting gun to gain coveted permission to compete in the race proper. . . . Man's newest victory over space and its traversal will be displayed by Clem Sohn of Lansing, Michigan, who, with a partner, will fly downward from 10,000 feet on bat wings, eerie-looking contrivances designed by Sohn. . . . Regardless of what today's humming activity brings, the thrill of yesterday's Bendix Trophy Los Angeles-Cleveland Derby in which Roscoe Turner, holdar of the Transcontinental record, trailed Ben. O. Howard, Chicago pilot-designer, across 2,042 miles of American terrain by the unbelievably narrow margin of 23 seconds, probably established the tops in thrills for the meet. It was the nearest thing to a dead heat aviation has ever seen and probably will accumulalte fame as unique in air history as years go on."

THE PILOT of the latest trans-Atlantic flight, after cracking up in Ireland, is quoted in the news as follows:

"The 28-year-old aviator, uninjured in the crackup and refreshed by a night's sleep, recalled the details of his harrowing 22-hour adventure alone over the Atlantic, saying 'Most of the time I was flying blind in rain, fog and mist—filthy weather all the way. When I tried to fly above the storm, ice rapidly formed on the wings, the carbureter froze and I had to thaw it out. I almost froze too, wearing only a light flannel suit.'"

We are so sorry to see our aviators suffering year after year as they do, and we do hope that Congress, when it reconvenes this winter, will repeal whatever law it is which requires them to make these flights.

JUST as we were beginning to think that aviation was well on its way to becoming a big business, we read that an airplane called "The Sky Louse" is becoming very popular in Europe, and our own Bureau of Air Commerce is testing an automobile engine developing 88 hp. at 3,800 r.p.m., which transmits its power to the propeller by means of six belts. Sometimes life seems to be a series of anti-climaxes for us—just a few years after we were allowed to wear long trousers, male adults started to go in for knickers in a big way.

AT THE TIME of going to press it appears that Mr. Howard Hughes, formerly of oil field and motion picture fame, has set himself up as a first class pilot by establishing a new world's speed record for landplanes. It is to be hoped that his new record remains established as long as the record in platinum blondes also set up by Mr. Hughes.

WE SEE by the papers that, in their recent war games the Russians are trying out the scheme of landing regiments of infantry behind the enemy lines by means of parachutes from large transport airplanes. This reminds us to make a note that, if we personally must take part in the new war which seems to be coming along so rapidly, to

try to get into the cavalry before that section gets too crowded.

A RECENT ISSUE of the New York *Herald Tribune* carries the item "Red Bank, N. J.: Stanley Herbert, a student pilot at Red Bank airport, went up for a practice flight yesterday. He landed on what looked like a clear field in West Oakhurst, but the field was not unoccupied—a dun-colored cow was resting in it. Two feet of the cow's tail were cut off by the propeller. No other injury resulted and the cow appeared more outraged than hurt."

In our opinion, Mr. Herbert would also be outraged if he were deprived of all defense against biting flies for the rest of his life.

Buyers' Log Book

AVIATION'S *Card Index of New Equipment*

This department is equipped to help readers locate manufacturers of any parts, accessories or materials

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LABORATORY EQUIPMENT — **X-ray Machine**

St John X-Ray Service, Inc.,
30-20 Thomson Ave, Long Island City, N Y.

FOR instruction purposes and for industrial use a new x-ray unit consists of a heavy lead-lined cabinet enclosing standard 200,000 volt generator and x-ray tube Rays escape from cabinet only through single window in top Specimen box fits over the aperture Two doors in front and moveable panels on top permit access to interior Safety device is incorporated so that neither high voltage nor x-rays can be turned on while box is open

AVIATION, *October, 1935*

MATERIALS — **Steel Data Book**

Bethlehem Steel Company,
Bethlehem, Pa

A VALUABLE addition to the library of anyone using steels is the new handbook "Bethlehem Alloy Steels," Catalog No 107. Purpose is to give users of alloy steels up-to-date working data on properties and performance. Covers five main divisions (1) grades of steel, (2) steels for specific uses, (3) properties of steel, (4) working of steel, (5) definitions and tables. Fabrikoid binding, 376 pp, price $1

AVIATION, *October, 1935*

PARTS — **Elastic Stop Nuts**

Elastic Stop Nut Corporation
Elizabeth, N J.

A "NUTS-BY-THE-YARD" idea is being supplied to aircraft manufacturers by Elastic Stop Nut Corporation for blind mounting applications where close spacing is required. These gang nuts are placed in an aluminum channel section of 030 in material anodized, at spacings of ¾ in., 1 in. or multiples thereof Sizes of nuts available are 8/32, 8/36 and 10/32, which can be obtained in the plain or countersunk type.

AVIATION, *October, 1935*

PARTS — **Roller Bearings (catalogue)**

Norma-Hoffmann Bearings Corp,
Stamford, Conn

NEW bulletin "Precision Needle Roller Bearings" now available. Needle bearings, employing a large number of long rollers of small diameter useful where space limitations rule out conventional types of anti-friction bearing (connecting rods, cam rollers, rocker arms etc) Bearings are available in metric sizes from 12 to 150 mm bore, are adapted to wide range of loads and speeds for variety of applications.

AVIATION, *October, 1935*

SHOP EQUIPMENT — **Air Hose Couplers**

A Schrader's Son,
470 Vanderbilt Ave., Brooklyn, N. Y

SCHRADER quick-acting couplers, designed for attaching and disconnecting equipment from compressed air lines Makes attachment of tools as simple and as quick as plugging into an electric socket Tools may be quickly interchanged at one or at several pipe outlets as well as at working end of hose. Couplers made of cadmium plated steel, airtight, permit free flow of air when in operation

AVIATION, *October, 1935*

SHOP EQUIPMENT — **Crowning Machine**

Northill Company, Inc,
5728 Santa Monica Blvd, Los Angeles, Cal

THE Carter Crowning Machine is a simple and inexpensive tool for forming and finishing sheet metal to various shapes on limited production Shaping of metal is accomplished by oscillating a suspended roller over shaped dies on a forming table. Accurately controlled variations in stroke and pressure possible Open throat. No limits to shape or size of sheets that may be handled. Normally manually operated, power attachment may be supplied if required

AVIATION, *October, 1935*

SHOP EQUIPMENT — **Electric Drill**

Skilsaw, Inc,
3310 Elston Ave, Chicago, Ill

SKILSAW line of electric drills rounded out by addition of two new small models and three heavy duty models The 5/16 in and ¼ in sizes designed primarily for aircraft and automotive assembly Compact (7½ in long x 3 5/16 in. diameter), light, well-balanced Two-pole Bakelite enclosed switch. Speeds 2,000 to 3,700 r p m The three heavy drills have capacities ⅝ in, ¾ in, and ⅞ in Die-cast housings, full ball bearings, helical gears.

AVIATION, *October, 1935*

SHOP EQUIPMENT — **Propeller Profiler**

Engineering & Research Corp,
6100 Sligo Mill Road, N.E, Washington, D C

COOPERATING with the Hamilton Standard Propeller Co (who have ordered six machines) a machine tool for accurate finishing of metal propeller blades has been developed and is commercially available. Propeller supported between head and tail stock on table Rotating cutter (5,000 ft. per minute) traverses blade under control of master cam. Micrometer adjustments. Three horsepower motor

AVIATION, *October, 1935*

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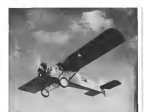

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Engines and parts. W. E. Berger, 6714 McKinley Ave., Los Angeles, Calif.

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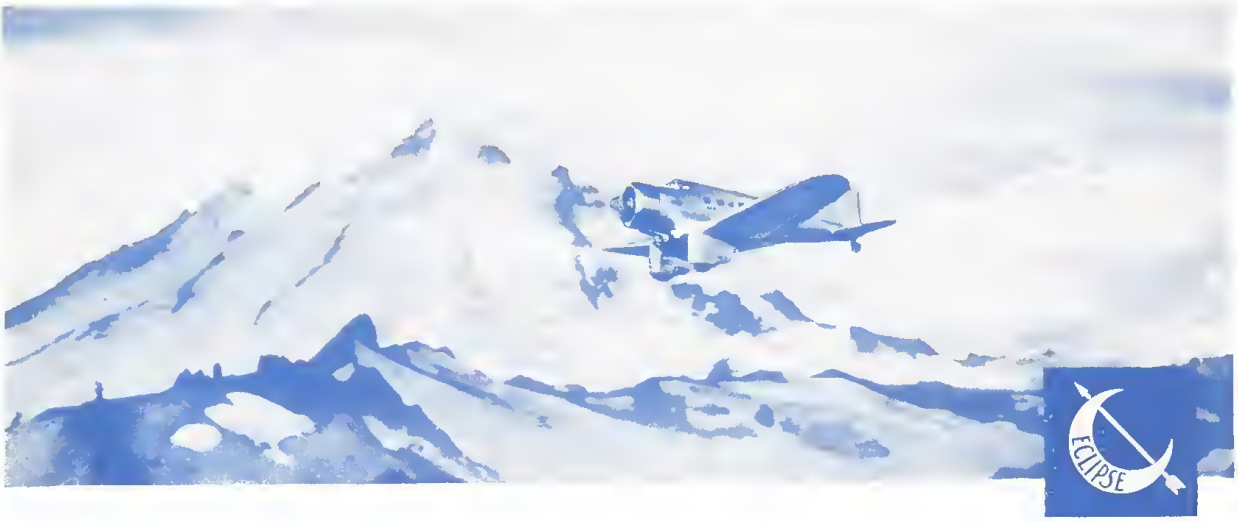

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